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Nature in Print

By HOWARD ZAHNISER

INSPIRED by Dorothy Edwards Shuttlesworth's book, *Exploring Nature with Your Child*, I recently made a proposal at my own dinner table that has set our whole family to exploring Nature anew. With William Hillcourt's *Field Book of Nature Activities* also fresh in mind, I used the categories that he has used in grouping his projects for specific activities — birds; mammals; snakes, lizards, and turtles; insects; water life; flowers and flowerless plants; and trees. What I proposed was that each of us make one of these categories a specialty and thus be prepared to answer the questions of all, or pursue the answers as best we could with the help of a library of good source books.

Alas, there are only six of us altogether, and thus it was necessary for someone to carry the responsibility for two groups. This fell upon Mathias, whose great interest in fish at the end of lines led him to choose eagerly the subject of water life, and then to agree also to be our agent for knowledge of snakes, lizards, and turtles. Mathias, with his fifteen years, is the oldest of the younger set, and well able to bear the added responsibility. This doubling, however, was otherwise fitting because it has ensured us of his help even during our dryland excursions, although there are, indeed, few trips afield of any kind that do not lead to some water life.

There was for a time at our dinner table some confusion in overlapping and conflicting choices, but after discussion, tentative assignments, and some trading we had our specialties all adopted. Esther is our bird student and Karen our tree expert. Edward specializes in insects (and spiders too), and their mother succeeded in holding on to her chief interest in "flowers and flowerless plants." It was interesting to me to note that the least challenging seemed to be that group that Mr. Hillcourt calls animals, mammals as we usually say, quadrupeds as Audubon called them. These creatures fell to my assignment, which was, of course, pleasing to me.

With these choices and assignments made, plans began to take shape immediately — plans of various sorts. Someone suggested a series of six family programs for Sunday evenings, or perhaps more often. At each of these we would have a lecture on one of the specialties, by its expert. (Here Mrs. Shuttlesworth's collection of interesting facts and interpretations would be most helpful.) The appropriate section of our library would be in the custody of the one most concerned. Our summer and other automobile journeys would be more exciting, and our camping and wilderness trips as a family would bring us closer than ever before to an understanding of the world in which we so much enjoy living. Our group's knowledge would soon become amazing, we were sure. At least one of us, I know, was delighted also with the prospect for working and playing thus together as a family.

But the immediate impulse at the dinner table where this proposal was made (it was during a midday Sunday dinner) was that we go on a hike. That we did. It was the first Sunday in spring, a glorious sunny day, but our various commitments kept us from faring far. In fact, Alice had already engaged herself for a concert and could not go at all. But before long the children and I were walking down the street of our Washington, D. C., suburb toward the nearest open space — the Heurich Place, we call it.

It is difficult to write of this without lamenting anew the myopia that leads us to take over for real estate developments (as we call them) all our open spaces. For the Heurich Place — an estate that long escaped the house building that has made a rural island of it now — is doomed, and we all know this as we cross its fence and stroll, run, scamper, or skip and dance through its field.

But we were excited by a new adventure theme. Edward (even with our help) saw only a bot fly. As it chanced (!) I saw not even a squirrel, although Mathias and Edward, on one of their side excursions, did see a cottontail scamper into the briars. Esther heard a meadowlark and stalked through the yellow-brown, almost golden grass (blowing in waves that Edward pointed out) to find that a song she had not recognized was being sung by a red-winged blackbird, which she watched and seemed to know with a new freshness. Two bluejays were conspicuous in the top of a black willow tree (Karen and I identified it tentatively there and again back home). The tree against the blue sky was delicately beautiful with a color that Karen called lime-green, and which we understood when we came close to the tree, for we saw then the delightful catkins that so modified the greenness of the new leaves.

Perhaps the greatest event of this initial hike in our new capacities came as Karen saw three trees together off a ways and speculated that they were oak trees, but was delighted, when we came nearer, to see that from their prickle-balls she could recognize them as sweet gums. We broke from one of them a short branch with both a prickle ball on it and new buds beautiful in their color. Around the three large trees were many small ones with the sweet gum's cork excrescences plain to see. Where the three large trees stood there was a narrow stream of running water, with one quiet pool where Mathias heard frogs. Some birds had flown from the trees as we came. I was sure that there must be squirrels in the tree at times, and Edward saw a hole where he said there could be insects sometime. We were impressed that we all could find something about our special interests in this one place. And most lovely of all was a scattering of Virginia spring beauties in the grass underneath the sweet gum trees.

A few yards further along we stopped under a sycamore tree, and it developed that, although it was just after dinner, Esther and Karen had had the forethought to bring along crackers and a few pieces of pound cake. These we ate, and all but one of us climbed the sycamore tree.

We had to go, for Esther had a four-o'clock committee meeting. Karen and I found in tree books accounts of sweet gum and sycamore and compared with illustrations the samples she had taken, and we found among Mary Vaux Walcott's flower plates her beautiful spring beauty. We had been gone on our excursion only an hour and a half, yet we had all had an experience that meant a great deal.

As I sat down later that evening to discuss these books in these pages it occurred to me that in no way could I suggest better their value than by relating thus our own homely experience. As I thought during our hike, and as I have contemplated it since, I am amazed at the many more things we could have experienced on even our short excursion with the aid of these volumes. But, as both our authors would advise, we were much more concerned with the joy of our undertaking, the spirit of our adventure, than with cramming into it all we could. We

Wasp Nest

By JOHN NIXON, JR.

Inside the farmer's mailbox hung
A tiny paper chandelier,
Suspended there to hold the young
Of striped wasps. They made it clear
They wanted nothing less nor more
Than privacy, a shelter, and
Time for descendants. They forbore
To sting the postman's daily hand.

But tragedy shaped like a fat
Mail order catalog one day
Crowded the chandelier quite flat,
Crumpled the wasp-dreams into gray
Waste paper, proved how perilous
A world wasps live in — thanks to us.

were sampling our opportunities together.

What I shall do now is to "lend" Mr. Hillcourt's *Field Book of Nature Activities* successively to each of our experts. It contains many suggestions for projects, more than 500 in all, and lists other books, and magazines, that are good sources of information and ideas. Its introductory chapters tell about sketching, photography, collections, associations, and camps, field trips, Nature games, Nature trails, museums, and workshops. I am excited with the thought of how it will help us in our undertaking. Its many drawings and suggestions for making things (I am looking at the moment at a drawing of a waterscope made from a wooden pail with a glass bottom) are sure to intrigue us. I can hardly wait to move it off my review shelf into its use and to watch its influence exerted.

Mrs. Shuttlesworth's volume on *Exploring Nature with Your Child*, to which I owe the inspiration for this present venture, will likewise be of continuing help. In homes where there are not available the reference books that it is our good fortune to have, this book would be of even greater value, for it is both detailed and comprehensive. Here, for example, are the topics in the chapter on "How to Understand the Birds," as listed in the "Contents":

"Feathers for clothes — why protective coloring is important — new feathers for old — the versatile beak — feet are versatile, too — sharp eyes and ears — how birds fly —flight techniques — the mystery of migration — sky lanes of the birds — flying hours — how fast do birds fly? — where birds migrate — how to keep a bird calendar — how to be a good neighbor to the birds — feeding the birds in wintertime — what birds feed on — identifying birds by their song — how to record bird songs — how to make birds feel at home — the hobby of nest collecting — baby birds — the chicken and the egg — how many eggs are laid — the size of eggs — bringing up baby — how bird babies are fed — getting ready to leave the nest."

The volume contains two other chapters on birds, "The Delightful Hobby of Bird Watching" and "Birds of Farm and Zoo." These are followed by "Animals in the Wild," "Animal Friends and Helpers," "Fish and Their Fabulous Neighbors," "Snakes and Frogs and Their Relatives," "The Wonderful Ways of Insects and Spiders," "The Fascination of Flowers," "Trees and How to Know Them", "Our Earth and Its Fellow Planets," "Recognizing the Stars," and "Understanding the Weather."

Exploring Nature with Your Child, as its title suggests, is a book for parents rather than for their children, and discusses children's interests as well as its Nature topics. This perhaps makes it not the most suitable work for the children's own guidance but rather a handbook for the parent, just what Mrs. Shuttlesworth planned, and as such something that can indeed serve a great purpose and enrich and inspire the real living together of the many families who can follow it.

Exploring Nature with Your Child: An Introduction to the Enjoyment and Understanding of Nature. By Dorothy Edwards Shuttlesworth. New York: Greystone Press. 1952. 448 pp. (6 by 9 1/8 in.), with frontispiece in color from a photograph by Cleveland Grant, 30 photographs on 20 plates, 106 text drawings (mammals, reptiles, and insects by Thomas Voter, fishes and other water life by Lloyd Sandford, birds by Robert F. Seibert, flowers and trees by Matthew Kalmenoff), and index. $3.95.

Field Book of Nature Activities. By William Hillcourt. New York: G. P. Putnam's Sons. 1950. 320 pp. (4 1/8 by 6 7/8 in.), with more than 120 drawings by Francis J. Rigney, numerous bibliographical references in the text, index of suggested projects, and subject index. $3.95.

Insects for Juniors

The Junior Book of Insects. By Edwin Way Teale. New York. 1953. E. P. Dutton. 249 pages. Illustrated. $3.75.

This fascinating introductory book on insects was first published in 1939, and has since had six printings. It now appears in a revised edition, in which the author has found little to change but quite a bit to add as a result of increased knowledge of insects. Besides introducing one to the fun of insect study as a hobby, this book provides many practical suggestions as to the full enjoyment of that hobby.

Bird Watching

A Guide to Bird Watching. By Joseph J. Hickey. New York. 1953. Garden City Books. 264 pages. $1.98.

First published in 1943, this book has become a standard guide to anyone taking up the pleasures of bird watching, a hobby that is not as simple as one might guess. The fullest enjoyment of bird watching will come through knowledge of where, when and how to indulge the hobby, either as an individual or as a participant in group activity. It is to be hoped that this new, reprint edition, at a more modest cost than the original, will aid many new bird-watchers, as well as please those who already find pleasure in this fascinating work and play afield.

Hawaiian Ferns

Ferns of Hawaii National Park. By Douglass H. Hubbard. Hawaii National Park, Hawaii. 1953. Hawaii Natural History Association. 40 pages. Illustrated. Fifty cents.

This is a special issue of *Hawaii Nature Notes* and is an introductory treatment of some seventy species of ferns that have been found to date in Hawaii National Park. It is liberally supplied with pictures.

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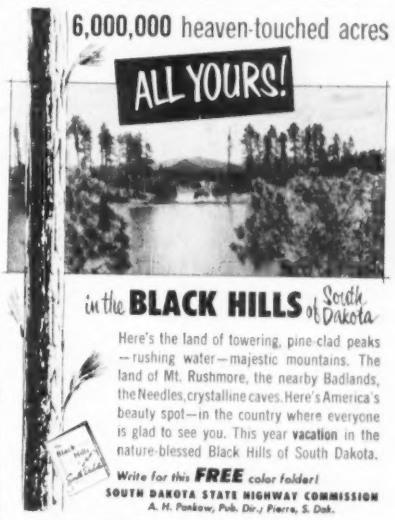
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IN THIS ISSUE

May, 1953 Vol. 46, No. 5

Nature in Print	Howard Zahniser	226
Wasp Nest (Poem)	John Nixon, Jr.	226
By Way of Report		230
Contents Noted	R.W.W.	231
White Echo (Poem)	Mozelle Pinckert	232
Blackburnians of the Pines	Louise de Kiriline	233
Do You Know These? (Quiz)	Edwin F. Steffek	236
Wild Flowers Deck the Aleutians	Ted P. Bank II	237
Daylight Saving (Poem)	Theo. H. Scheffer	240
Shrews — but Untamed	George Ballou	241
Housing Project (Poem)	Richard F. Armknecht	243
Schoolboy Explorers	Cecil Hampshire	244
The Amazing Fungus Ants	Ross Elliott Hutchins	245
Did You? (Poem)	Jane Merchant	246
The Bushmaster of South America	E. Ross Allen and Wilfred T. Neill	247
Processional (Poem)	John J. Tunney	248
Some "Game" Birds	E. Laurence Palmer	249
A Plea for Private Property (Editorial)		257
The True Conservationist	Alexander F. Skutch	258
Spring Industry (Poem)	Grace Stillman Minck	261
Earth-Slit in the Calicos	Nell Murbarger	261
Home Life of the House Finches	Patricia Bailey	262
Pequot-sepos, A Unique Community Program	A. W. Wright	265
In the Zodiac	Isabel M. Lewis	268
May Flowers — Double Feature (Poem)	Ray Romine	269
The School Page	E. Laurence Palmer	270
Camera Trails	Edna Hoffman Evans	272
Under the Microscope	Julian D. Corrington	278

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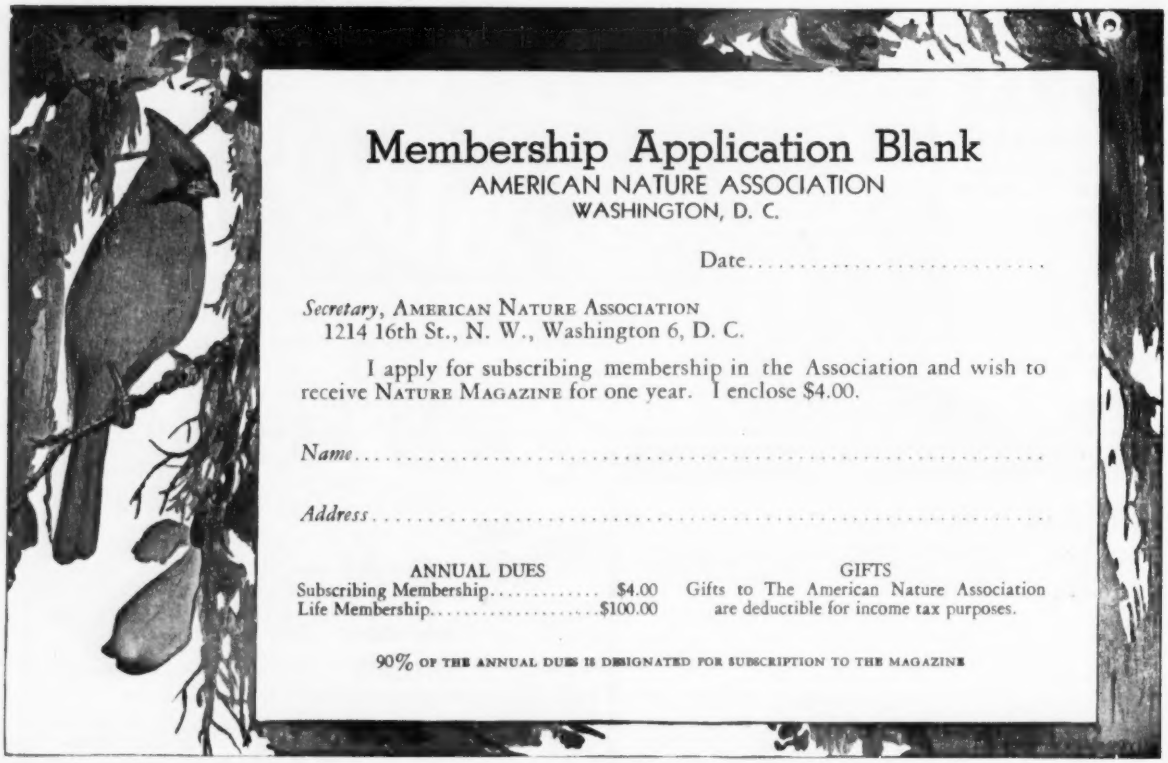
By Way of Report

At the recent sessions of the North American Wildlife Conference, and the annual meeting of the National Wildlife Federation, held in Washington, D.C., the Association was represented by its President, Richard W. Westwood, and Vice-President Radcliffe. The Association sponsored a well-attended special meeting of the President's Quetico-Superior Committee, at which Mr. Westwood presided. Mr. Westwood also served on a conservation education panel session of the National Wildlife Federation, with our Director of Nature Education, Dr. E. Laurence Palmer presiding. The Wildlife Conference, sponsored by the Wildlife Management Institute, established a new high in attendance, outstripping all previous seventeen conferences.

Following the two above-mentioned meetings, a progress meeting on the three-year conservation project of the National Association of Biology Teachers was held. This program is being carried forward with the help of a substantial grant-in-aid from The American Nature Association. A set of criteria for teaching conservation in biology has been developed; workshops implemented; state and regional committees created, and a series of bulletins that will present the results of the project in practical form for use by teachers outlined.

Following the Presidential election there was a spate of rumors about what was going to happen to our natural resources in National Forests, National Parks and other public lands. They all added up to dire prospects for such common properties, which were variously pictured as destined to be handed back to the States or presented to private owners. It was known, of course, that special interests have gazed enviously at the standing timber in National Parks and National Forests, and that stockmen yearn to get control of grazing on public lands of all kinds. Although there was nothing in any statements by President Eisenhower, or any indication from Secretary of the Interior McKay, that lent support to these rumors, conservationists felt that it was not safe to dismiss the aims of special pleaders as merely rumors. These rumors should not be allowed to burgeon into policy for lack of an expressed opposite viewpoint. So a group of conservation organizations, including The American Nature Association, formed the Emergency Committee on Natural Resources. Through this group those in authority have had called to their attention the conservation viewpoint, and the committee will continue to act as long as the need appears to warrant. The Association's Vice-President, Harry E. Radcliffe, represents us on that Committee.



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Contents Noted

CLEVERLY written, and innocuous, on the surface, the long-expected bill by which western livestock operators hope to acquire a firm grip on grazing privileges in National Forests has been slipped into the legislative hopper. It was introduced by Congressman Wesley A. D'Ewart of Montana, has been given the number H.R. 4023, and has been referred to the House Committee on Interior and Insular Affairs. There is considerable protestation of good intentions in the bill's wording, so much so that the proposed legislation raises suspicions, which examination proves justified. Two sections are so phrased that the stockmen would acquire a vested right in grazing privileges on National Forests, long their goal. Timber values and watershed control are the basic objectives of these forests, but the terms of the bill would greatly weaken Federal authority in carrying out these purposes. This promises to be a much-argued move on the part of special interests with ample funds to fight for special privileges. Conservationists will represent the public interest, which they regard as paramount.

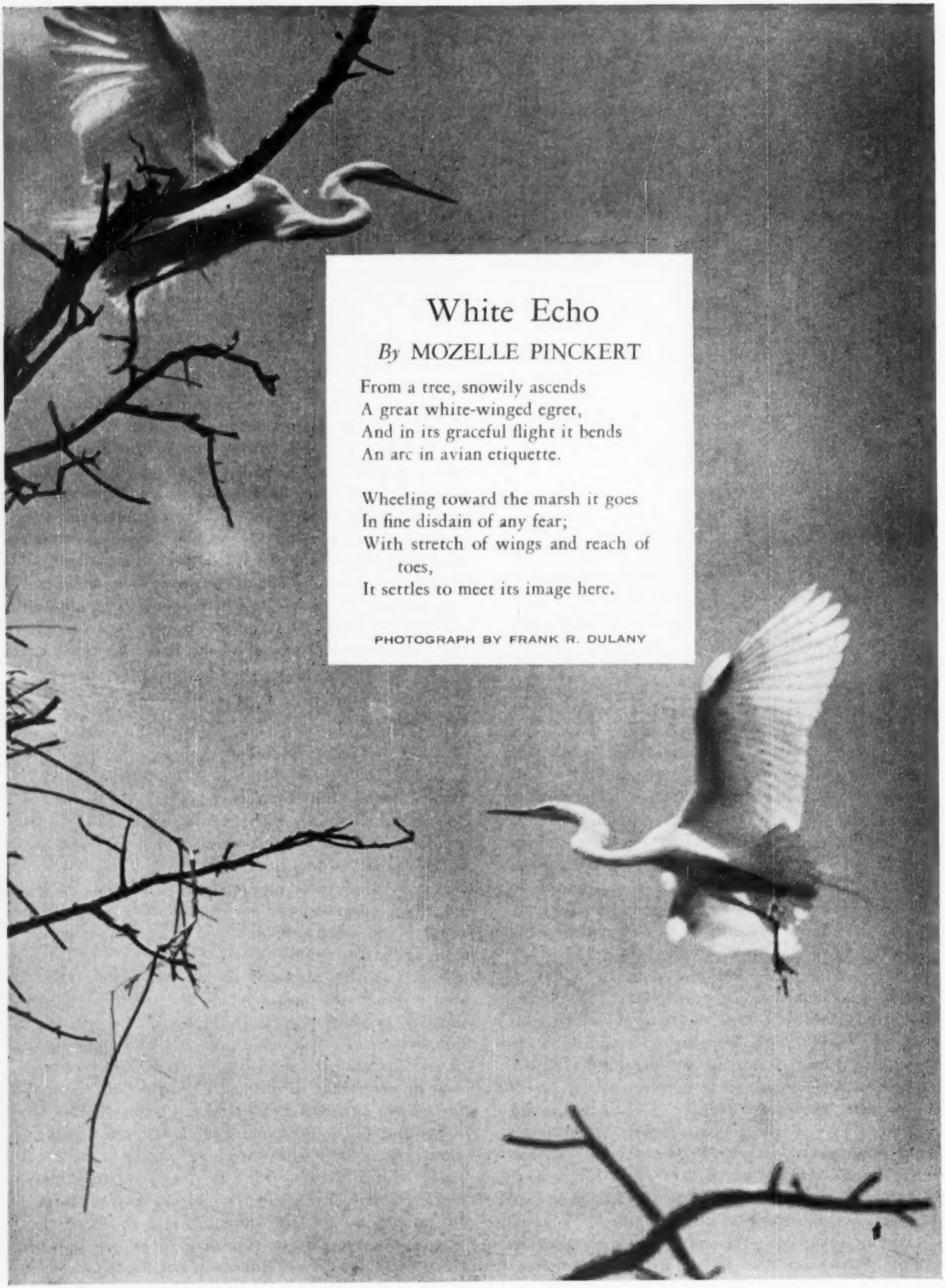
"PICTURE windows" are giving birds a bad time. This architectural development of recent years has created a hazard of surprising proportions, and certainly has complicated the business of being a bird. Reflecting sky and foliage in their spotless glass, the windows prove a lure to birds, which fly into the panes and are killed, or so badly injured that they become quick and easy prey for cats and dogs. Mrs. Clough Gates of Superior, Wisconsin, has been a bird enthusiast for many years, and at home and in her travels has been gathering information on the extent of damage to bird life by these windows. It is surprisingly large and general. Mrs. Gates is not campaigning against such windows, for she has one of her own, but does urge the arrangement of drapes and plants in the windows to break up the reflections. Curtains, for example, should not be entirely closed but a gap of a foot or so left to provide variation. A little study of the reflections and experimentation, she says, will allow one to have birds and picture windows, too.

THERE seems to be a growing conviction in the Northwest that rural billboards and natural scenery with a high sales value do not mix. A bill introduced in the Oregon legislature and enjoying considerable favor, and, of course, active opposition from the outdoor advertising industry, is a case in point. This proposal would ban highways signs except near larger cities and in the vicinity of roadside businesses. The city of Seattle is writing new restrictions on outdoor advertising. One county in the State of Washington — Clallam — has quintupled the tax rates on billboards in the hope of discouraging them. In other quarters the relationship between highway accidents and the distraction of attention caused by the billboard is receiving increasingly serious consideration.

FOR generations the Yakima Indians have fished the Columbia River at Celilo Falls. As a tribe they entered into a treaty with the Federal Government to protect these rights. "As long as the snows remain on the slopes of Mt. Adams," the pact, nearly a century old, reads, "and as long as the Columbia flows, and as long as the sun sets and rises, shall the treaty last." Our record of keeping faith with the original Americans is something to which we cannot point with pride, and it would appear that we are about to add another blot to this record. A dam is proposed to be built at The Dalles, Oregon, which would destroy the Celilo Falls, and, with them, the prehistoric rights of the Yakimas. The Indians are fighting this, and they are not alone, for many Oregonians, who believe that the "Great White Father" should keep his word, have rallied to fight with them.

EQUALLY aroused are the people of the Blue Valley, Kansas, who are fighting the Tuttle Creek Dam, which would displace some 4000 people, flood 55,000 acres of rich farm land, inundate nine towns and wipe out some six million dollars worth of annual food production. So aroused are the citizens of this district that they elected a Democrat to Congress in a rock-ribbed Republican district. With reason, the Kansans point out that the topography of the region is not suited for storage dam purposes, and that the proposed construction would not aid flood control. It is high time that we review these dam projects, and check some of the high-handed activities of the Army Engineers.

RECENTLY we received an inquiry from one who describes himself as an "amateur naturalist and free lance outdoor writer." He wrote that he had long felt that a serious study of Nature builds up a closer and stronger relationship with God. So he asked us to recommend books or other writings that put emphasis on this point; works that relate Nature and the conservation of natural resources to Christianity. We consulted our memory, our considerable Association library and bibliographies. We found practically nothing that we could suggest. In fact, we were rather appalled at what appeared to be a philosophical blind spot. Surely our own reading and our own library must be at fault! Certainly there must be significant publications in which one can find Nature and religion as an inspirational team, so to speak. Our correspondent observes that there must be works "dealing with the subject of becoming a better Christian through the study and full understanding of God's great gifts of natural beauty. We have too many people in the world today who call themselves Christians, yet they know nothing whatsoever about their natural surroundings." In despair, we turn to our readers in the hope that they can suggest some such sources as our inquirer cites. And we would like to know of them, too. R.W.W.



White Echo

By MOZELLE PINCKERT

From a tree, snowily ascends
A great white-winged egret,
And in its graceful flight it bends
An arc in avian etiquette.

Wheeling toward the marsh it goes
In fine disdain of any fear;
With stretch of wings and reach of toes,
It settles to meet its image here.

PHOTOGRAPH BY FRANK R. DULANY

Blackburnians of the Pines

By LOUISE DE KIRILINE

Illustrated by Clarence Tillenius

All of a sudden spring came. There was that special feeling in the air, that tender caress of the south wind upon my cheek, that peculiar fragrance of myriad unopened buds. The birches stood decked with pendulous blooms, and their tiny crinkled leaves pushed impatiently out of their sticky coverings. With a crown of pale green, the quaking aspen looked like a young innocent attired in her first party dress. Even the austere evergreens unbent before this special occasion and sent forth a heady perfume of sun-baked, glistening resin. The stage was set.

A song heralds the first arrival, a song that has not been heard for many months but that now, in its fresh first rendering, seems lovelier than ever. Gorgeous in his multi-colored spring dress, an animated warbler appears, the first seen, on this day, of these enchanting sprites of the woods that belong to the Americas alone. He moves through the trees, hopping along the branches, a flash of color playing hide and seek with the watcher in the dappled sunlight. Often he flutters like a suspended butterfly at the end of a twig, busily picking tiny insects with his slender bill. At set intervals, he stops, raises his head towards the blue heavens and gives forth his sentence with wide-open bill, possessed by such an ardor that his body quivers violently from crown to tip of tail. And in that inspired sound and gesture all Nature's truth and essence are encompassed.

Then uncountable warblers surge through my woods in a gigantic wave of color and movement. Song fills the air. Endless variations of color patterns flit past my field of vision with exasperating rapidity. Fleeting glimpses of yellow breasts, with streaks or without, of wings plain or with bars, a bay line along a flank, a chestnut cheek patch, a blue hood, often afford the single chance of recognition, sometimes with the conclusiveness of a certainty, but often vaguely lacking the additional marking that would have settled the matter.

Throughout North America, from south to north, these scenes are repeated each spring. But to most bird-watchers, many of the warblers are transients, only to pass quickly, to be heard and seen briefly, and then to be gone. Finally, perhaps hundreds of miles north of the International Border, they reach the vast lands of lakes, rivers and forests, where their breeding grounds begin.

There is one among the warblers whose name seems to fit it singularly well — Blackburnian, although in

Two males vied with one another in whirlwind pursuits alternated by pauses in challenging attitudes on respective twigs.

fact it is called after a bird enthusiast named Blackburn. This feathered elf in black and white, with throat aflame and dashes of orange on crown and cheeks, prefers the northern coniferous forest, and goes there to nest either in the mountain ranges at higher altitudes or in the north. Perhaps, therefore, the striking plumage of the adults, which differs little between the sexes, and does not change much with the seasons, is what most bird-watchers in the southeastern part of the hemisphere know best about this warbler.

In the "Loghouse Territory," my study area so named from the house we live in, 250 miles almost due north of Toronto in Canada, the Blackburnian warbler may be seen during four months of the year. A few of them stay there, seldom longer than sixty days, during their nesting season.

The female Blackburnian warbler feeds her young, although the male also does his part.

When he appears in the spring, in full song, this warbler is one of a large group of birds whose arrival dates fall within the second and third weeks of May. From the top of the tallest tree come his high notes announcing his presence, mounting the scale with emphasis and deliberation until lost entirely in the uppermost register, "zree-zree-zree-zree-zree-zree-eee-eeee." One may ask, how many of these thread-fine Blackburnian notes do we actually miss? Judging by the comparative infrequency with which he utters his songs — I have counted two and one-half to six in a minute — it might well be that none of us have ever heard the actual finale of this bird's song, which may be far beyond the capacity of the human ear.

Around our house is a fine locality for a Blackburnian territory. It contains everything that this warbler seems to prize most — tall well-feathered evergreens interspersed sparingly with young and full-grown aspens and white birches, and slopes with dense growth that harbors rich supplies of small moths and other insects included in his favorite menus. It also has water. But this is evidently no obligatory condition, although a fine asset in midsummer, when clouds of mayflies arise from the lake to dance out their brief existences and then to cling helplessly to every twig and leaf. Then all a warbler has to do is to pick and eat. For many years the Blackburnian tradition has been maintained upon this land, and the destinies of a pair and their offspring, developed and fulfilled each season; but not in an unbroken line, since both the male and the female have changed identity in the interval.

In spite of the fact that there is no lack of suitable habitat in this locality, the Blackburnian warblers do not settle close to one another. Usually two, never more than three pairs have occupied sites within the sixteen-acre Loghouse Territory. The living-space required by each pair is not much more than two or two and one-half acres, but to settle border to border appears well-nigh out of the question, and a buffer-zone of "no bird's land" seems a necessity. Whether the reason for this is a sparse population of the species in general or downright intolerance, remains to be determined. The fiery belligerency of Blackburnian males about their territory, and their frequent entanglements with unsettled males with obvious intents of annexation, make the question even more puzzling.

One such encounter lasted a whole afternoon. Accompanied by high-pitched squealing, in whirlwind pursuits alternated by pauses in challenging attitudes on respective twigs, two males vied with one another for the possession of land, vegetation and partner. In a striking manner they showed off their orange-colored spots, dashes and bibs by ruffling these fiery feathers. They quivered their wings and spread their flashy black and white tails. In the course of the battle, neighboring myrtle, magnolia and mourning warblers, as well as a red-eyed vireo, also were involved in the fracas, and this caused the Blackburnians to become highly excited and to lose their heads completely. But, all of a sudden, the whole affair dissolved with the disappearance of the intruder. Hostilities were dropped forthwith and everybody returned to their previous occupations.

The female arrives, on an average, eleven days later than the male. But this interval varies considerably and depends on such factors as the weather and the number of females that actually pass through the region. In one instance it was twenty-three days, the male arriving at a record early date, May 8, and the female at a record late date, June 1. It would seem that these circumstances combined adversely on this occasion.

The female Blackburnian is a beautiful little bird, demurely dressed in a subdued version of the male's brilliancy. In her, his bright orange patches are paler, and the vivid contrast of his black and white markings

softened. It is of note, too, that all the females I have known personally exhibited dispositions quite in keeping with this modesty of attire. They are birds that go about their business in a detached and airy way, efficient and adept, but seldom tempted to frivolities. In my experience, all the tempestuousness in the Blackburnian belonged to the males.

I am even under the impression that the female's acceptance of the male's invitation to stay is less of her doing than his. True, she may have directed her flight to the place whence she heard his song, but he meets her with such persuasive demonstrations of wings and tail and his whole body, that she is hardly left a choice. And having convinced her, he fusses over her, guards and pursues her with a zeal that, not only would she indeed have difficulty in escaping before the nest attaches her to the spot, but he, temporarily, forgets to sing.

Soon after this, the female begins looking for a nest site. For the most part I have found her settled in the tops of the stalwart white pines around our house. One nest was situated far out on a branch, forty feet from the ground; another was wedged into a three-pronged upright crotch at a height of fifty-five feet, in a rather bare spot close to a sticky bunch of opened cones. But a third one, which was the second nest of the pair, I found almost invisibly hidden in the bushiest part of a horizontal branch of a white spruce, not more than twenty-six feet from the ground. At two of these nests, a young poplar beside the nesting tree served the birds as a stop-station before they entered the nest site. But in the case of the nest in the crotch, the female habitually "spiralled" up the trunk of the pine, appearing and disappearing, until she neared the top and then hopped sideways along the branch to the nest, to the onlooker a most confusing approach until he learned her method.

It is surprising to note the extent spider webs are used in the nest-building of this warbler. The nest in the spruce was literally suspended from its moorings in twigs and leaves by this adhesive material, like the cradle that hangs instead of stands. The female found the webs on twigs of bushes and trees. She took a piece in her bill and pulled; if it stuck she applied her weight by falling backwards and hanging on to it, fluttering until it gave way. Sometimes she carried it in small, whitish balls in her bill, or else in loose strands trailing behind her. The existence of these invisibilities was revealed only by the bird's movements and impediments as she dragged the fine stuff home over branchlets and twigs.

During the nest-building, the male spends his time in close attendance upon the female. He sings; he escorts her to and fro; he watches her. He may go to the nest and sit down in it for a few seconds, as if to learn what a good nest ought to feel like. But this is all the help he gives her with the actual building. Perhaps it is just as well. The nest in the spruce took three days to complete; but on the third day both birds were not very attentive in comparison with the almost frantic fervor with which they applied themselves, each in his own way, during the first day.

Incubation is a time of rest for both birds, for the female on the nest and for the male in the territory. He sings a great deal, feeds, wanders, fights if occasion presents itself. Sometimes he comes to the vicinity of the nest and, with a song, signals to the female to come off; sometimes he accompanies her upon her return. Once in a while, he approaches his sitting mate and feeds her a morsel, which she accepts, her head thrown back and her wings lightly aquiver. She alone incubates the eggs. She turns them quite often, using feet and bill. Her usual time on the nest is twenty-two minutes, and five minutes are generally enough for her to feed and rest, sometimes a little more or less.

". . .a pigeon hawk swept out of the sky."

After twelve to thirteen days the young hatch. Now dawns the period when the male makes his greatest contribution to the raising of his family. At least this is what happened at the crotch nest from which I gained most of my information. Already on hatching

day the male feeds twice as often as the female. But as the young grew older and needed less brooding this difference evened off and the father fed them a little more than one and one-half times as often as the mother.

Events at this nest took a dramatic course and I happened to be present at the crucial instant. On the day the young were four days old, a pigeon hawk swept out of the sky, pinned the female to the nesting branch, and the next second dashed away with her dangling from the talons. I shall always regret the loss of this little bird in a personal way, and I shall never know whether she, with her greater versatility in the care of the young, knowing both how to feed and to brood them, would have been able alone to raise her family had the male been taken in her stead. But, on the other hand, the death of the mother bird brought the male's functions into high relief.

She was killed in the morning in the absence of the male. But he soon became aware that something was amiss. When he came to the nest he looked about him, hopped and flitted around, as if searching for his mate. Often, previously, he had come while she was brooding, and as he fed the young she perched on the rim and thereafter settled down to brood again. Moreover, less than half an hour after the tragedy, the young, now fed only by one parent, became hungrier, and their insistent gaping stimulated the male to more frequent feeding. In the time I watched, during the twenty-four hours in which he succeeded in keeping them alive by himself, he stepped up his feedings to an average of once every fifteen minutes. In this way he maintained fairly well the previous feeding rate of both parents. But he did not know that the brood needed warmth as well as food. This part of the program belonged to the female and it was not laid down in his behavior pattern. And for this reason, all his efforts were in vain.

That disaster overtook all three of my nests must not be taken as an indication of an exceedingly low rate of nesting success for this warbler. It was only that the nests I happened to find were not favored by fortune. But if six Blackburnian warblers come to nest in our neighborhood, I have good evidence that at least eight or nine leave the area when they begin moving southward in late summer, even in years of highest unsuccess. For so long as the Blackburnian habitats remain undisturbed and adequate for the bird's needs, I firmly believe that the racial powers of perpetuation of the species are equal to the drain of any normal rate of mortality. This seems true in spite of the fact that a second unsuccessful nesting attempt ending in July is not followed by another re-nesting.

The male of the crotch nest began to sing again after his last young died, once more to announce himself as an eligible mate. For two weeks he sang with great vigor and persistency, even into the late evenings. And then he was no longer there. But the next spring he returned to the pines overshadowing our Loghouse. For how could it be any other individual that took up the same territory and sang the very same kind of songs!

Do You Know These?

By EDWIN F. STEFFEK

SEE how many of these plants you can identify from the descriptions. The answers on page 274.

1. The first one is a plant that has no chlorophyll and, therefore, cannot manufacture its own food. It has a characteristic shape, similar to that of a common object used by the Indians and is a denizen of the deep woods.

2. It has leaves like a maple and a stem like a bramble. Its flower is large, pink to purplish and appears in summer. An edible fruit follows later. Likes the edges of woods.

3. Plentiful in Pennsylvania, growing in open woodlands. This flower blooms in spring. Its flower is white and hides beneath the umbrella-like leaves. Greenish fruits are produced. These are often eaten by small boys.

4. Strictly a summer-bloomer, this one attracts many butterflies. The flowers are purplish and borne on a long spike. Unlike most plants, it blooms from the bottom up. Sometimes also found in perennial gardens.

5. One of our daintiest wild flowers, only a few inches tall, with slender wiry stems and bell-like flowers of blue. Although found widely over the Northern Hemisphere, it is generally associated with Scotland.

6. Beautiful white chalices in the spring, followed by large roundish leaves. A brilliant red dye once used as a cough medicine and as a war paint characterize this little woodland dweller. Do you know it?

7. A dainty little plant beloved of the Pilgrims. Its leaves are evergreen and its little pink flowers, appearing very early in the season, are delightfully fragrant. The State Flower of Massachusetts.

8. This is truly a bog plant, found from the Gulf States to Labrador. Since nitrogen is scarce, it gets its supply from insects, which it traps in its hollow leaves. The reddish-flowered one is the most common, the official flower of Newfoundland.

9. Beautiful blue beads follow the inconspicuous yellow flowers borne in early spring. The large, oval, glossy leaves are also characteristic. Found in rich, acid woodlands along with the bunchberry or dwarf cornel.

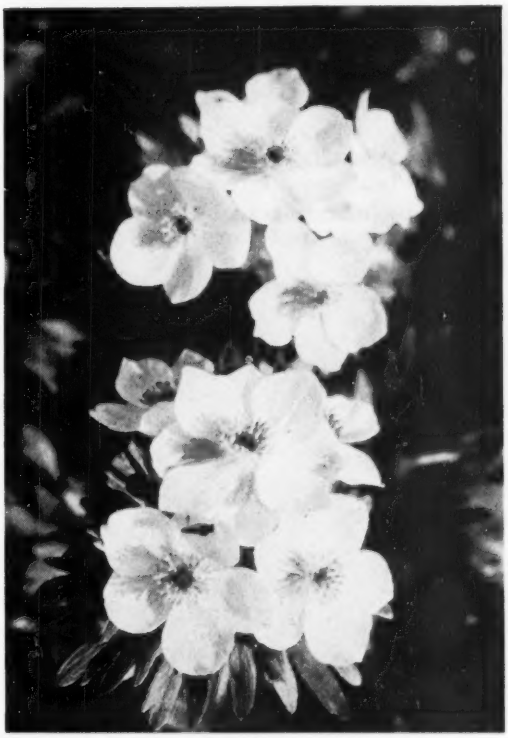
10. A graceful woodland plant with attractively cut leaves. When in bloom it is almost indistinguishable from its red-fruited cousin. Its own berries are white with a black spot on each like a doll's eye.

Atka village in the Aleutians. This is North America's farthest westward native village. Its population in 1949 was 72 Aleuts and 2 whites.

Wild Flowers Deck the Aleutians

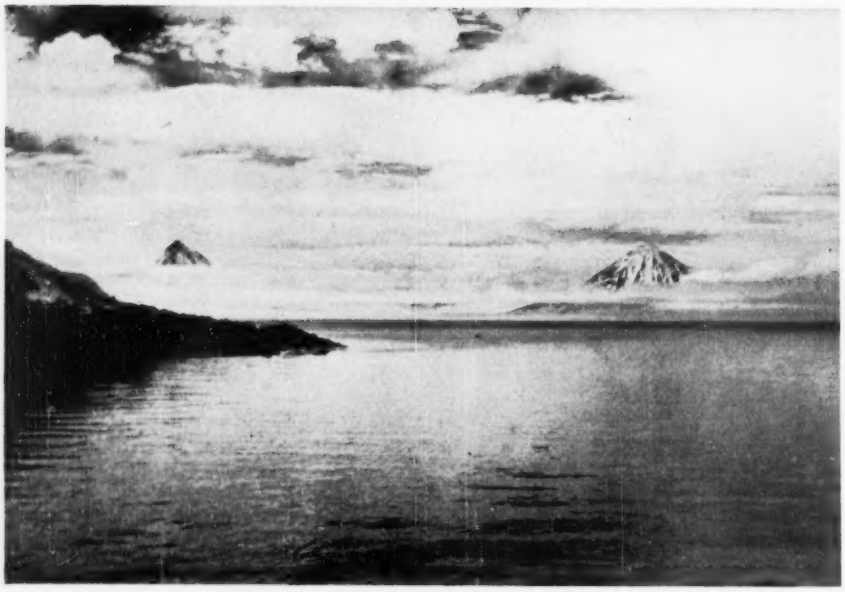
By TED P. BANK, II

IN THE minds of most persons who have heard of them, the Aleutians are a dismal place, barren and frozen. Yet, they are not so at all. They got much of their bad reputation during World War II from soldiers and sailors who found themselves stationed in the Islands, which are dubbed the "cradle of the storms." When censorship was lifted and the men could write about their surroundings, they unconsciously furthered an untruth in their letters to the folks back home. They described chiefly the wintry blizzards, wild winds called williwaws, thick fogs and treeless tundra. Few home-bound letters contained also the observation that each summer the Aleutian mountain sides are splashed with the brilliant colors of myriad wild flowers, and that each valley, large or small, possesses a tumbling stream whose banks and boulders are covered with velvety green mosses and liverworts.



Beautiful white flowers of anemone, frequently seen growing like patches of snow on the high mountain slopes.

Our servicemen, however, were not the only ones to overlook the Islands' better features. Until the recent war scant attention was paid them, even by scientists, and comparatively few of the articles that have been written about the Aleutians describe their amazingly varied wildlife, magnificent scenery and interesting native people, the fast disappearing Aleuts. The Aleutians have been called desolate and barren. Yet, these islands have some of the largest sea-bird colonies in the world, where puffins, murres, kittiwakes, cormorants, guillemots and auklets nest by the millions on the rocky cliffs, and island ponds are homes for loons, teals, mallards and mergansers. Certain of the islands are indescribably beautiful, for the volcanic peaks, some of them active, form almost perfect snow-covered cones, rising above the ocean like glistening



Two of the four volcanoes of the beautiful Isles of Four Mountains in the Aleutians. Mount Cleveland, at the left, and Mount Carlisle, at the right, are both active volcanoes. Part of Uliaga Island in foreground.

jewels in a turquoise-blue setting. The climate, although frequently raw, is far from being Arctic, for, indeed, they are only a few degrees north of the U.S. boundary. Even in winter, temperatures seldom fall below 15 degrees Fahrenheit. This is because of the presence of the Japan Current, which flows from the South and warms them.

The Aleutians are stormy, however, and for this they deserve some of their reputation for cold. They lie between the Japan Current and the colder waters of Bering Sea, much like a gigantic sieve, and, thus, the islands are caught in an unceasing turmoil of opposing air movements. Fogs and low-hanging rain clouds are formed. But because of this wet, temperate climate, many plants are able to cover rocky mountain slopes with a lushness that somewhat resembles tropical growth. Stretches of tall grasses, wild parsnips, lupines, and ferns grow so abundantly in ravines that the ground is completely hidden, and a man penetrating this tangle of plants may find the vegetation taller than he is.

The Aleutian Islands extend for 1200 miles in an arc, a huge upturned crescent reaching from Alaska almost to Siberia. Attu, the westernmost island, is only 450 miles from the shores of Kamchatka. So it is not surprising to find that North American plants predominate on the eastern islands, and Asiatic species in the western part. The middle islands have a mixed flora of wanderers from both continents. Here is where East meets West, at least in the plant world.

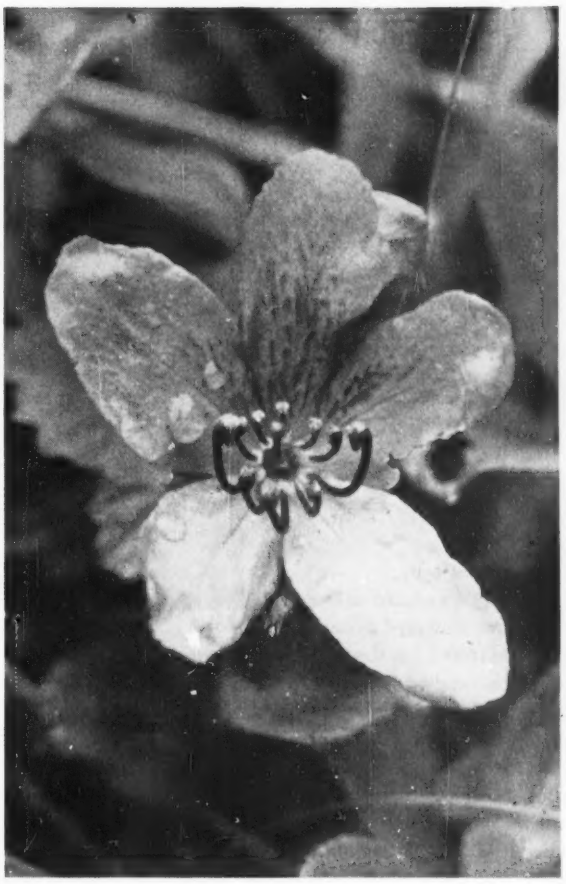
Plant collecting in the Aleutians is a stimulating pursuit, for the botanist must conquer truly rugged terrain composed of sharp basaltic outcrops, high cliffs, and imposing volcanic peaks. But there is much in Nature to intrigue him. There are striking changes in vegetation as he climbs from shore to mountaintop, and each ravine he explores may offer something specially interesting and beautiful. There are strange plants near steaming hot springs, alpine flowers nestled near towering banks of glacial ice, and forests of prostrate willows that never grow taller than six inches! A common sight, yet always fascinating, are large, sod-covered, conical mounds, some of them twenty feet high, which occur atop some rocky cliffs near shore. These mounds were built during hundreds or thousands of years from the excrement of countless roosting sea birds. The botanist with an archaeological bent will find in the still warm volcanic caves the remains of mummified dead, and, covering the bodies, fragments of plants and

A bird mound almost twenty feet high on Atka Island in the Aleutians. These mounds are formed from the excrement of sea birds over a period of many hundreds of years.

plant materials woven into exquisite matting that was used, in times past, by an ancient Eskimo people akin to the modern Aleut.

The shores of these islands are always rocky, and sandy stretches are seldom encountered. But behind the boulder beaches occur wet tangles of wild pea, scurvy weed and wild rye grass. Ragwort, *Senecio pseudo-arnica*, the pink-flowered Siberian spring beauty, *Claytonia sibirica*, and yellow buttercup are also found here. Usually the terrain rises abruptly from the shore as rocky cliffs, except where broad, green valleys sweep toward the inland mountains. In these valleys there are green meadows of tall grasses. The white umbels of cow parsnip, *Heracleum*, cover the hillsides like patches of glistening snow. Blue spikes of lupines peek from an ivory carpet of exquisite *Anemone narcissiflora*, and, bluer still, are the large blossoms of the poisonous monkshood, which grows tall and straight among the grasses and the parsnips.

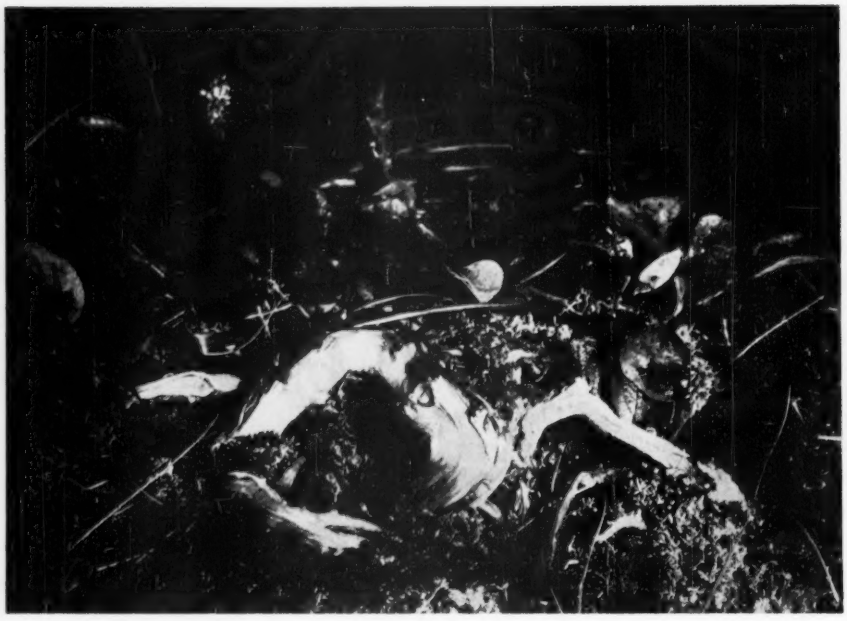
Bordering most rushing streams and at the bottoms of grassy hills are flats that are always wet and boggy



Kamchatkan rhododendron, at the right, is a gorgeous rose-red flower, two inches across. It grows near streams and can be found in the mountains. Below is a spike of wild parsley with, at its right, a plant of everlasting among tall grasses in an Aleutian meadow.

from the constant seepage of underground water. Here are found some of the most beautiful flowers in the North — the delicately tinted purple orchid, *Orchis aristata*, and its fragrant companion, the white orchid, *Platanthera*. Also growing here is the less fragrant black lily, *Fritillaria camtschatcensis*, whose bright yellow stamens sit in a cup of purple-black petals. The lousewort, *Pedicularis*, is a beautiful flower, and it, too, is a frequenter of the wet places. Another, for which the botanist must search persistently if he wishes to find it, is the brown and ivory-colored lady's slipper, *Cypripedium*. Along the steep banks of rushing mountain streams grows the brilliant scarlet Kamchatkan rhododendron, often bathing its blossoms in the mists of waterfalls.

As the botanist climbs he comes upon thick heath-lichen-moss carpets, which cap all rounded knolls, and mantle the middle slopes of the mountains. Walking across them is like walking on a large innerspring mattress, but after a rain this is a wet experience, for the mosses hold great quantities of water, and each step produces a miniature geyser that may splash over boot tops. As the summer progresses, however, these moss carpets become dry, and provide the tired camper with a truly luxurious mattress for his sleeping bag. In late summer they furnish edible fruit, for cranberries, bunchberries, *Cornus suecica*, and dwarf salmonberries,



The hardy, gnarled dwarf willow, a stunted shrub that may grow along the ground for many feet, but only six inches tall.

Rubus stellatus, grow here. But all of these plants might be blown away if it were not for the presence of two tough, woody plants whose roots and branches cling to the hillsides and give protection from the winds. These are the widespread *Empetrum nigrum*, whose berries are much sought by Aleut children, and the hardy, dwarf willows. These are the Aleutian "forest," only a few inches tall.

Still higher on the mountain slopes are scattered lichens and a few tattered heaths. These upper reaches of vegetation are lonely places, swept almost bare by constant winds. They are the areas pictured by most visitors as being the typical desolate tundra of the far North, made so by extremes of cold. Actually, the plants that cling to these higher slopes are dwarfed and gnarled, not so much from cold as from lack of water, for, despite the presence of almost constant rain and fog, these high places suffer from the desiccating effects of never-ceasing winds that sweep across them. Yet plants can grow here, and the alpine rocky terrain is home for many flowers that are amazingly delicate and colorful. There are the bluebells, *Campanula*, yellow and white pussytoes, *Antennaria*, gold thread, *Coptis*, a primrose and many saxifrages. These plants must have some shelter to survive. A boulder, a slight depression in the ground, the protection of a gnarled willow stem, or any place that will permit moisture to accumulate or protect the leaves from the swift air currents, will suffice.

On the very mountain tops in early summer, when the *Cladonia*, called reindeer "moss" although a lichen, is still bone-white, the gray rocks of winter become green, yellow, and red as the various lichens upon them revive. Desolate gravel slopes are transformed as if by magic into beautiful natural gardens by the pastel colors of countless tiny flowers. Even the snow banks and ice fields of the tallest peaks are sometimes splashed with gorgeous scarlet, so colored by microscopic algae, "redsnow," that grow only in such places. And if the botanist or other seeker of Nature's wonders has attained a peak summit when the clouds below have parted, he can look out across the North Pacific and see the green islands stretching far before him, to disappear in the distance. They may then seem to him truly to be stepping stones between two continents.

★

Daylight Saving

By THEO. H. SCHEFFER

Good morning, Morning! Abroad so soon?
The day as yet leans light on noon;
Dew cups of night are proffered still
where elfin woodfolk drank their fill,
and grasses in the dipping glades
yet lave in mist their naked blades.

On tufted grass and spreading leaves the
thrifty spider dries her weaves,
That taughtened strings may snare such things
as early risk their lacy wings;
the lowly earthworm ducks its head
at sense of robin's wary tread.

Good morning, Morning! Abroad so soon?
The paling moon yet lags her span
and sun hangs fire in the priming pan!

Shrews—but Untamed

By GEORGE BALLOU

Photographs by the Author

Portrait of a shrew, showing its tiny eyes, small round ears and long snout.

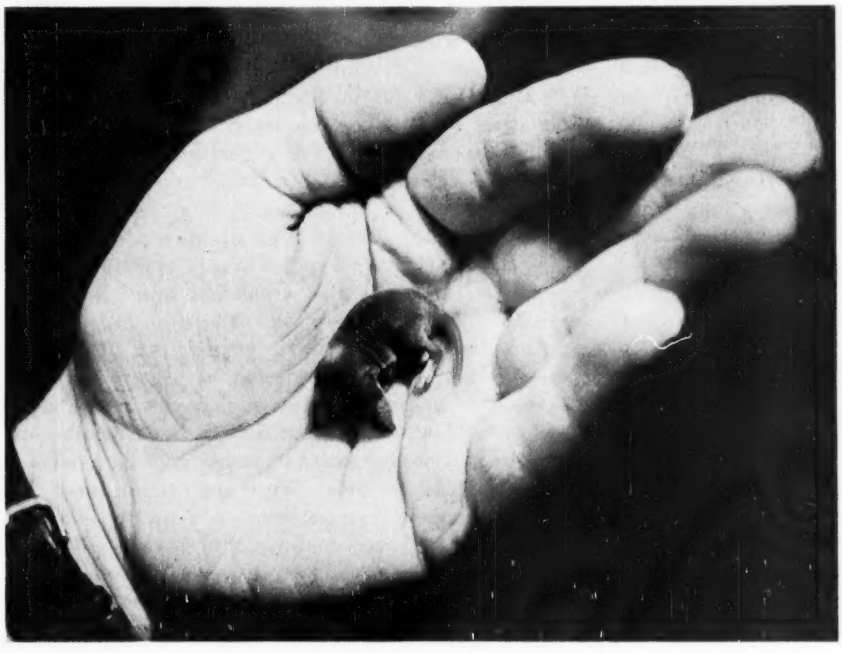
ARRIVING at my home near Zurich, Switzerland, in October, I was greeted by a succession of shrill squeaks that came from the tall grass across the road. Then came silence, followed by the same vibrating sound from another spot. I investigated carefully, listening. My ears soon caught a crunching sound, followed by what seemed to be happy peeps, then more silence.

It was a community of shrews, and the observations of the following month seemed to indicate that half the shrew population of Zurich had taken up residence in this spot. Besides the peeps, crunchings and trills, one often got a glimpse of quick, gray forms, and occasionally of one shrew chasing another. Now and then I was able to catch a couple as they fought, or a lone shrew preoccupied with a meal of an autumn beetle.

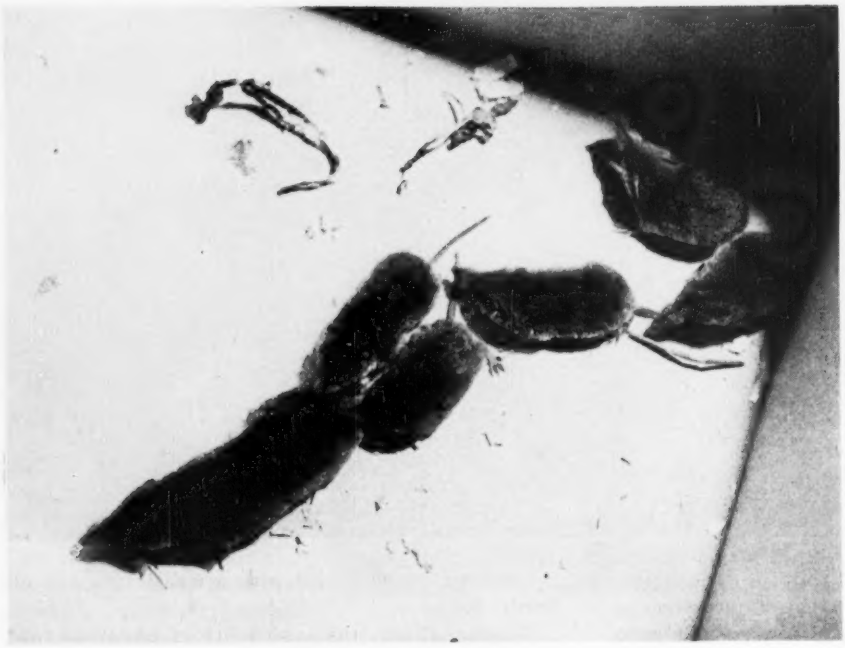
Whether it was the availability of plenty of food, the protection of the taller grasses, or whatever else, I certainly had a concentration of these little animals handy for observation. And in my trampings about the countryside I never came across a comparable settlement, but only lone stragglers here and there.

During November this shrew citadel was at its height. The animals were seen chasing one another, dining on insects or worms, rushing through the parted grass fibers, or aimlessly wandering along meandering lilliputian pathways. Whenever shrews were needed for observation they were there. But little by little winter invaded the land; the calls of the shrews diminished. After the first snows one heard and saw less. Tiny tracks led underneath motherly spreads of grass. I placed a mass of paper and straw there, for refugee shrews to find shelter, and they used it. It became a sort of Shrew Salvation Army Camp.

However, when I returned, after a Christmas trip, there was nobody. I made a point of scrutinizing the area day after day in hopes of encountering even one little fellow. Whether they had starved to death — as happens — died of



A two-weeks-old baby. After several quivers and a few peeps, he fell asleep in the hand.



A shrew "train." Just before the photograph was made all six were attached in line, although only two now doggedly grasp the mother.

other causes, become cannibalistic, journeyed to another locale, or tunneled under the snow, I shall never know. And there was a sad dreariness about that snow-encrusted domain with its occasional knobs of tufty winter grass poking through. From time to time, up to March, a mournful survivor was heard. Yet the kingdom of the shrew was no more.

These shrews are the European equivalent of the common American species, *Sorex cinereus*. The two related species are the wood shrew, *Sorex araneus*, and the house shrew, *Crocidura russulus*. Whereas the American species has a brownish summer coat, changing to gray in winter, ours are different. My own shrews, by April, lose their winter pelage, which is reddish-brown in some cases, for an ashen-gray summer one. Furthermore, the teeth of American species are stained with chestnut at the tips, which is lacking in those of Europe.

The shrews have been easy to keep in captivity, and even breed. It surprised me, too, that a mother was able to raise her young in the same cage with two other adult shrews, for they respected her nest.

I feed my shrews on beef, liver, worms, snails, cheese and dry oatmeal, with some other tidbits for variety. If left many hours without food they die of starvation, having an extraodrinarily high metabolism. A young litter favored cream cheese.

There have been several families and ample opportunity to observe how mama behaves. First she makes a tight, compact nest, the inside being somewhat smaller than a hen's egg. There four to eight pink and hairless young are born. Superficially they resemble new-born mice. As they develop, their miniature snouts become very wide on both sides, which gives a strange expression when they are three weeks old. The snouts are later covered with hair. If the mother is disturbed and leaves the nest, her young will remain attached to her, being dragged about. A little later, when they have become more aggressive, two or more babies will hastily attach themselves to mama by seizing her fur. Then, no matter how fast she goes or where, they stay along. If only one baby can grasp mama as she departs, *all* the rest will hitch to each other, like a miniature train. I have seen such a line chugging along for some time. But when the mother relaxes they eventually uncouple. Or the first may become weary and drop off. However, this only happens when they fear the family is threatened, at other times the mother repeatedly leaves without any cargo.

In the autumn I heard raucous sounds coming from a small hole, which I enlarged to reveal a nest of four adult shrews, all peeping and squeaking. Six months later they were all well. Unfortunately they emit a strong odor when excited, their most potent defense. Since shrews, or at least these, must lead an exciting life, the smell is usually present. Having been squirted directly in the face by skunks, I can testify that an enraged shrew smells much like a skunk. Put a shrew in a jar. Then sniff in it and you should begin imagining moonlit nights and squirting skunks.

People here, as in the United States, seem to be unaware of what a shrew really is like. They either call it "mouse," "mole," or, perhaps, know the German name — *Spitzmaus*. But their knowledge usually stops there.

The common shrew is a small, grayish or brownish insectivore, about four inches long. Its body is always a-quiver, and his long, trunk-like nose continually shakes. His vision is poor. The eyes are sad little specks which, nevertheless, he can use. His small round ears are nearly covered in winter, but more prominent in summer. The toes are five in number on all feet. The tail is about a third the animal's total length, and covered with fine, nearly invisible hairs, and a few odd, longer ones. When you catch a shrew you detect the musk secreted from the ventral glands, and he can bite. He will continually utter shrill trills, during which his long snout seems to grow into a miniature trunk. Sometimes you may even hear his warm little peeps, especially when he enters the nest of a friend.

Month-old baby shrews, showing the long snouts. Neither is moving, which is a rare event with these little animals.

He may be with his wife, as they may remain in pairs, but usually are alone.

Whereas mice happily accept vegetable matter, shrews will disdain it unless on the verge of starvation. Yet one will ferociously attack a piece of beef, or, for that matter almost any insect, worm or meat scrap. A young mouse will, too. When a shrew eats a large chunk he will put his paws on it like a tiny lion, and for convenience may drag it into his nest. If need be he will store it in a corner. Food in a pantry often bears the shrew's scent.

When recently holding a handful of baby shrews I had the impression of six tiny, throbbing, electric charges. The bumblebee-sized forms vibrated with extreme rapidity and the slender snouts quivered. Then, in their attempts to "make a nest," to somehow find security and hide, there was a continual reshuffling as each sought warmth and darkness under his brothers. A moment later they were sleeping, or at least dozing. Here and there one would awaken with a minute shiver of his whiskers and then go to rest again.

Something I find extremely comical, but the baby shrews do not, is when they scratch their fleas. I will not insult them by saying they have many, but certainly some. Once I saw all six tormenting their fleas with such quick movements that I could only keep up by saying "brrrrbrrrrrrrr" to myself. Their almost phrenetic scratching can be clearly heard (their nest is on newspaper) and it resembles a mingled succession of lightning-quick drum beats. The shrew deserves the title of speediest flea-scratcher.

So far there has been only one case of cannibalism. A young shrew ate his sister. I do not believe them to be as ordinarily cannibalistic as some observers report. If hard pressed they may prey on their relatives, but normally this is not the case. So I have been able to raise several families in the same cage with other adults.

Economically the shrew aids us in destroying great numbers of insects, and perhaps some mice and other small life. If damage is done it is negligible.

A most intriguing fact about this beast is that he is the world's smallest mammal and almost "seems to know it." As if weighted down by this solemn fact, he lives an incredibly strenuous existence. One imagines that he shivers from that awesome reality: "I am the world's tiniest mammal."

Housing Project

By RICHARD F. ARMKNECHT

In April, frantic industry
Begins in every bush and tree
As feathered folk, in ancient rhyme
With Nature, start the nesting time.
The robin plasters mud and twigs;
With busy beak the flicker digs;
The lark and bobwhite bend the grasses
Above their mates; the hawk amasses
Great rafts of sticks, each nest a crotchful;
The wrens and martins flutter watchful
About apartments they have rented;
The friendly bluebird builds contented
Upon a shelf beneath our eaves;
With wisps of grass the song sparrow weaves
His dainty bowl . . . Each bird and mate
Seek to improve their real estate,
Each in the fashion of his kind
On plans conceived time out of mind.

How swift, efficient, ably planned
This building boom in Feather Land!

Schoolboy Explorers

By CECIL HAMPSHIRE

A secondary base camp of the schoolboy explorers on the Iceland expedition of 1952.

SIXTY-FIVE teen-age boys, members of the British Schools Exploring Society's 1952 expedition, safely returned to Britain after spending six weeks in the chilly wastes of Iceland. Working from a base camp established 2000 feet above sea level, the boys mapped nearly 100 square miles of wild and trackless territory, carried out meteorological observations, and collected many specimens of plants, rocks and insects. Included in the expedition were boys from Iceland, Canada and Australia.

One specially selected party of twelve boys, in charge of an assistant leader and a doctor, went on a "long march" lasting fourteen days. During this gruelling test of stamina and endurance the party covered 140 miles over mountains and lava-strewn desert, and forded 161 rivers and streams.

Other marches lasted from two to seven days, and many of the boys climbed to the summit of the Hekla volcano. This involved a round-trip journey of 52 miles in full pack and equipment, and an ascent of 5000 feet to the smoking crater amid snow and lava.

The British Schools Exploring Society was founded in 1932 by Surgeon-Commander G. Murray Levick, a medical officer in Britain's Royal Navy who was a member of Captain Scott's last expedition to the Antarctic. Its objects are to teach schoolboys to fend for themselves in difficult conditions and largely unknown territory, thus developing initiative and self-reliance, and fostering the spirit of adventure.

The boys are selected from volunteers between the ages of 16½ and 18½ from public, secondary and other schools, and cadets from youth services. The expeditions are arranged to take place within the summer vacation period. On the first trial venture to Finnish Lapland eight boys took part. Five years later the number had risen to 76. Today hundreds volunteer, but numbers are limited largely by considerations of cost and the availability of travel berths.

Since World War II the cost per head has risen to between $365 to $420. Normally the boys pay their own expenses. But the Society receives grants from trust funds, scholarships, local education authorities, and donations from private trusts and individuals. Thus boys unable to afford the total expenses are enabled to take part.

Some of the schoolboy explorers take advantage of an Iceland hot spring for a swim.

Expeditions have been made to Lapland, Newfoundland, Iceland, Norway and northern Quebec. In these regions, areas hitherto unknown or little-known have been explored and mapped in detail by the boys. Bird skins, many rare plant and insect specimens, and many valuable data have been obtained. In 1953 the Society plans to visit an uninhabited area of British Columbia, when it is hoped that Canadian schoolboys will take part.

The expeditions are in charge of an experienced leader aided by assistant leaders, who are commissioned officers from Britain's Navy, Army and Royal Air Force. Accompanying them are two or more doctors, depending upon the size of the party.

Each expedition carries out scientific work with instruments and equipment lent by various Service (Continued on page 274)

The entrance to the underground passages of the fungus ants.

Usually there is a small crescent of sand about the opening.

The Amazing Fungus Ants

By ROSS ELLIOTT HUTCHINS

STRANGE things are found only in far off places. That is a common belief, but, in fact, one's own locality is a "far off place" to someone a thousand miles away.

So look about you and you may be astounded by what you find in a nearby patch of woods.

Perhaps, you have read about the Sauba ants of tropical jungles, ants which cut sections out of the leaves of trees and carry them off to underground passages where they are used as a medium upon which to grow fungus gardens. This fungus, not the leaves, constitutes the food of these interesting ants.

It may come as a surprise to many to learn that in the United States we have several different species of ants that maintain fungus gardens that are just as amazing as those that occur in the Tropics. Colonies of these ants are found all the way from New Jersey to Texas.

Beside Mississippi's Pascagoula River, which is also called Singing River, there is a sandy bluff near its upper reaches. This bluff is clothed with palmetto and long-leaf pine; and sweet bay and ironwood entangle their roots near the river's margin. The time is May and the ascending sun paints a mosaic of light and shadow on the brown, needle-covered forest floor. The dew of last night has been dissipated by the heat and nothing seems to move. Nothing except, perhaps, a banded mason wasp that busily gathers moist earth from the roots of a fallen tree to fashion its nest on the limb of a nearby pine.

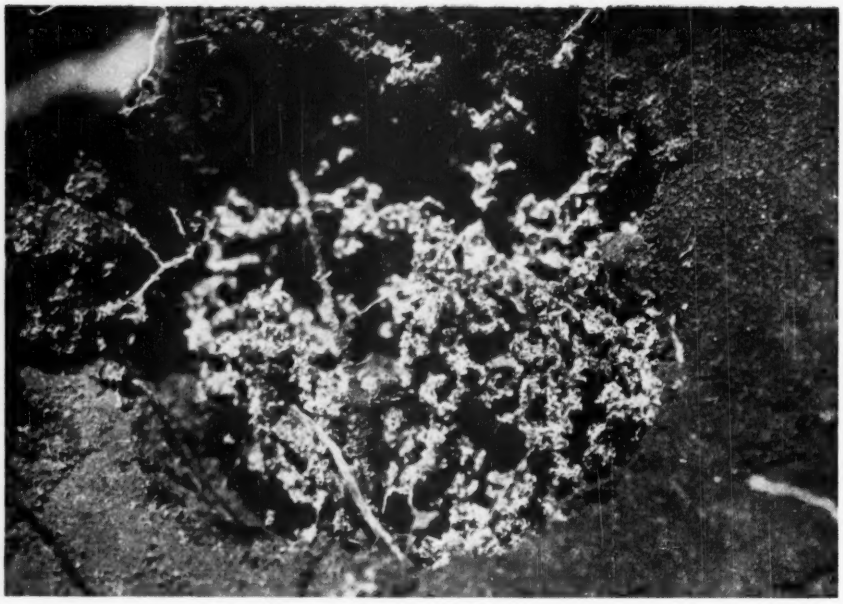
But there is more to this scene than meets the casual eye. Near the base of a towering pine is a little crescent of sand. At its center is a small hole a quarter-inch across. Small ants, unhurried and deliberate, are entering this hole and descending into the darkness below. In their jaws they carry bits of leaves, petals of flowers and caterpillar droppings that have been gathered from the forest floor. Six inches down this shaft is a spherical chamber and here the ants deposit their burdens and then return to the surface for another load.

At the bottom of this chamber is the opening of another shaft that continues downward. Occasionally an ant emerges from this opening, makes a selection from the pile of stores, and disappears with it down the shaft. Let us follow one of these ants. It has chosen a bit of green leaf from the pile and started downward. The shaft leads straight down into the earth and is dark as only an underground cave can be.

A foot down, the ant comes to another spherical chamber. This one is larger, and otherwise different from the first one. In the excavation of this cavity the ants were careful not to disturb the small tree roots that now extend across it like clothes lines. Hanging from these roots are masses of a blue-gray material of a sponge-like structure. Here and there over its surface are small spherical fruits that resemble kohlrabi. This is the fungus garden of the *Trachymyrmex* ants.

Let us watch the ant carrying the leaf fragment. It enters the chamber, pauses and begins chewing the leaf into a small mass. Now the insect carefully deposits this in the mycelial mass of the fungus garden and pats it in place with its feet. The ant pauses a moment to clean its antennae and then walks over to a kohlrabi head and devours it with evident relish.

The fungus garden is a pure culture of a special fungus that is found nowhere else. The ants continually work at it, fertilizing it and protecting it from contamination. Theirs is a one-crop economy. Without this fungus they could not exist, and probably without the ants the fungus would die. It is not only the adult



The ants carefully fertilize and care for this fungus garden deep in the sandy soil.

ants that feed upon the fungus. Scattered about in the pendant masses of mycelium are the larval ants, and they, too, obtain their nourishment from it.

And so the little colony of three hundred fungus-growing ants continues its busy horticultural pursuits during the long spring days beside the Singing River.

Spider lilies push their creamy blooms up out of the rich humus of the swamps and the bellow of alligators is heard through the dusk of evening. The sun incubates the eggs that the turtles have buried in the sand of the river's margin, and the cottonmouth moccasin bears its young.

Time passes, and it is June. Deep within the nest of the fungus ants there is an atmosphere of expectancy, for young queens and drones are now being developed.

Eventually these royal sex forms emerge from their pupal cases. They have wings and are quite unlike the worker ants. Now takes place one of the most amazing instances of the operation of animal instinct. Before leaving the parent colony each young queen takes a mouthful of the living mycelium of the fungus garden. This is her dowry, and it is as valuable as life itself, for without it she would be unable to start her own fungus garden. There is great excitement in the colony as the queens and drones crawl up the shaft to the sunlit realm above and at once take off into the aerial medium that they have never seen.

Many hazards await the swarming queens and drones, and only a few survive to mate. One queen mates in the shelter of a wax myrtle bush and, before nightfall, she descends to a patch of open ground and begins excavating a hole. She has shed her wings now, for their brief period of use is over. She digs downward into the earth a few inches and then makes an enlargement at the end. Then she seals up the nest entrance and spits out the bit of fungus mycelium that she has retained in her mouth cavity. This tiny portion of the parent colony is her life insurance, and she guards it with great care. She fertilizes it with her own excrement and it slowly begins to send out new mycelia. Soon the eggs that have been developing within her body are laid upon the growing mass of fungus. Queen Trachymyrmex has no other source of food so she eats some of these eggs, leaving the remainder to develop. Time passes and the small fungus garden continues to grow. The eggs hatch and develop into larvae, which, in turn, change to pupae. Eventually out of these emerge worker ants and at last the queen is no longer alone. Now her future and the future of the colony seem assured.

These workers, few though they are, now open up the nest entrance and begin gathering vegetable matter to fertilize the fungus garden. It flourishes and soon there are more workers to expand the activities of the incipient colony. As for the queen, she no longer labors at the work of growing fungus for she has become nothing more than an egg-laying machine.

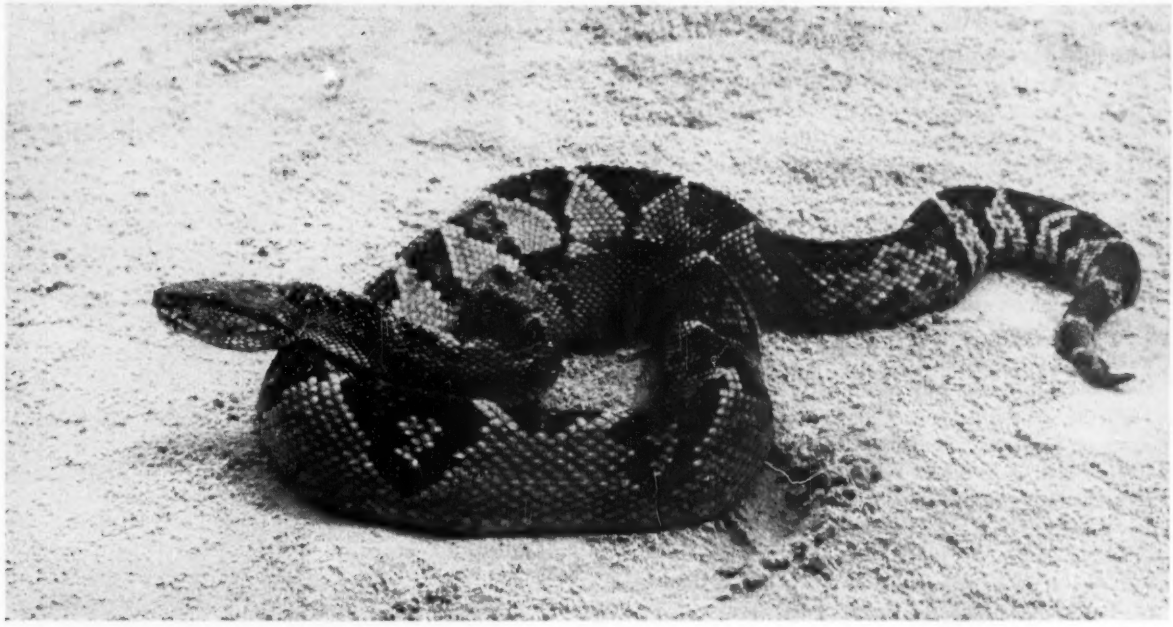
Eventually the original cavity becomes too small and a shaft is sunk downward into the earth and the fungus garden transferred there. The old cavity is now used only as a storage point for fertilizer material gathered from the forest above.

And the Singing River flows onward to the Gulf by dark and tortuous ways, while such life dramas are being enacted by little dwellers along the river's moss-draped margins and in other places, if one will look.

Did You?

By JANE MERCHANT

Did you ever see a jonquil looking dreary?
Did you ever see a robin looking glum?
Did you ever see a star appearing weary?
If you did, just think how worried you'd become.



PHOTOGRAPH BY KEN GOODMAN

A huge bushmaster, the most feared reptile of South America. A full-grown specimen of this snake may be eleven feet long, or more.

The Bushmaster of South America

By E. ROSS ALLEN and WILFRED T. NEILL

BACK in the 1700's, the great naturalist Linnaeus set about classifying and naming all the plants and animals of which he could learn. For the South American bushmaster he selected a Latin name meaning "the silent rattlesnake." Actually, this name was not entirely inappropriate, for the bushmaster superficially resembles some of the rattlesnakes, but lacks a rattle on the tail. About thirty-seven years later, a French scientist decided that it was not really a rattlesnake, and so, falling back upon Greek mythology, he chose for it the name *Lachesis*, after one of the three Fates who cut short the thread of life. Thus, almost from the time of its discovery, the sinister nature of the bushmaster has been emphasized. And in nearly two centuries that have elapsed since it first received scientific notice, not much has been added to our knowledge of this dangerous reptile. Few specimens have ever been brought to the United Sates, and, indeed, the bushmaster is not often seen even in its native lands.

It was therefore with a great deal of interest that we read a letter from a friend in Surinam, promising the immediate shipment of a huge bushmaster. We were just a little dubious, however, for in South America a great many snakes are miscalled bushmasters. A recent shipment, prominently labeled "Three Bushmasters," had actually contained harmless tree-boas! When the wooden crate finally arrived from Surinam, we opened it cautiously. Within was a sack, fairly bulging with some big reptile. Peeking into the sack, we caught a glimpse of tan and black pattern and of rough, sharp-edged scales. It was a bushmaster, very much alive, and a full seven feet in length.

The bushmaster is reputed to be very aggressive. In South America we had been told that it would stand its ground when approached, or even glide forward to attack. The big specimen from Surinam was docile enough, however. Placed on the open sand, it made no effort to fight, although it did vibrate its tail angrily a few times. The tail of the bushmaster bears rings of little, rasp-like scales, and terminates in a hard spine. When the snake is disturbed, it sets up an angry buzz by vibrating the tail tip against the ground, or among the dead leaves of the forest floor.

The bushmaster is the longest venomous snake of the New World. Our seven-footer was just an average adult. A few nine-foot bushmasters have been found, and the maximum length is said to be more than eleven feet. However, in actual bulk the bushmaster is exceeded by the diamondback rattlesnake of the southeastern United States. A seven-foot diamondback is stout, and much heavier than a bushmaster of equal length.

It is often said that the bushmaster has the longest

fangs of any New World snake, but we did not find that to be the case. Our seven-foot specimen had fangs a little more than three-quarters of an inch long. A six-foot diamondback has fangs of about the same length. The forked tongue of a snake is a harmless sense organ; fangs are sharp teeth in the upper jaw. In the case of the bushmaster, the fangs are hollow and much like hypodermic needles in action. They are covered by a protective sheath of tissue; and when not in use they fold back against the roof of the mouth An accompanying photograph shows the bushmaster biting down on a card; the long fangs and protective sheaths can be seen plainly.

Photographing the bushmaster's fangs proved to be a difficult procedure, even for one experienced with poisonous reptiles. The scales of the bushmaster are hard and sharply ridged. When the snake was grasped, it thrashed about, and the sharp scales rasped unpleasantly on the skin.

The big reptile was placed in a roomy cage, and after about three weeks it laid a half-dozen eggs. The eggs were large, each about four inches long, and much more elongate than the familiar birds' eggs. The shells were very soft, almost tissue-thin. Unfortunately, the eggs all proved to be infertile. We had hoped to hatch them, for baby bushmasters had never been reported. The egg-laying habits of this snake are of considerable scientific interest, for all its nearest relatives give birth to living young. The bushmaster, rattlesnakes, moccasins, and lance-head snakes belong to a single family, popularly called the pit vipers; and all the New World members of this family are live-bearers except the bushmaster.

The ground color of the bushmaster varies from dull yellow or tan to pink, orange, or even red. Crossing the back are a number of coal-black bands, each outlined with yellow. In the open, a bushmaster is conspicuous indeed; but in its own habitat it affords a wonderful example of Nature's camouflage. The pinks and tans blend with the dead leaves and humus; the black bands resemble shadows, and serve to break up the snake's outline; the yellow borders of the bands look like patches of sunlight dappling the forest floor.

PHOTOGRAPH BY WILFRED T. NEILL

As the bushmaster bites down on a card the white fang sheaths are drawn back, and the long fangs can be plainly seen.

The bushmaster ranges from the lowlands of Costa Rica southward through Panama, Colombia, Venezuela, the Guianas, and much of Brazil. It also occurs on Trinidad. Usually it inhabits forested regions, and often dwells in holes dug by armadillos, anteaters, or other mammals. Secretive and thoroughly nocturnal, it is seldom seen, even in areas where it may actually be abundant. Thus the exhibition of a bushmaster creates nearly as much interest in its native home as it does when it is on display here in the United States.

Processional

(For Susan on her birthday and Spring's Anniversary)

By JOHN J. TUNNEY

While planets wind their pendulums to swing
In perfect harmony through winter skies,
New star horizons curve and slowly rise
To glorify the miracle of Spring:

Great constellations lead — as one command,
An everlasting litany of praise
In solemn grandeur and majestic phrase,
According to the master-score first planned.

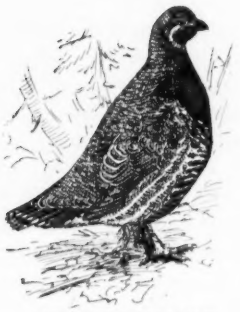
In grand processional, Orion wheeled
His starry legions on their westward flight
Where sunset banners guard the rim of night,
And proudly marched from Spring's celestial field
In vast parade beyond the bend of time,
Through silences, eternal and sublime.

Some "Game" Birds

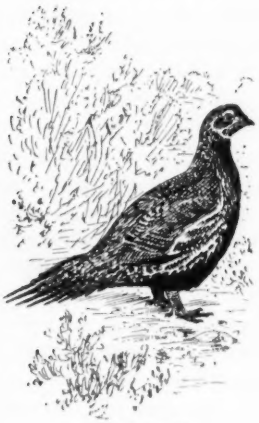
By E. LAURENCE PALMER

Illustrated by Edwin Sawyer, Hope Sawyer, Louis Agassiz Fuertes and the Author.

This is the seventy-first in NATURE MAGAZINE'S *series of educational inserts.*



SPRUCE GROUSE



SAGE HEN

PINNATED GROUSE

WHITE-TAILED PTARMIGAN

THE NINTH feature in this series dealt with some water birds and some birds described as "upland game." There was not adequate space in that unit to introduce some of the many important species in that group. Therefore, we take pleasure here in adding an even dozen to those that were presented earlier. In our selections here we have listened to the taxonomist, and chosen only birds that are rather closely related. All the birds included here are properly considered as gallinaceous birds.

Should we be studying ornithology these days, according to the most recent classifications, we would find that all of these gallinaceous birds are divided into three families. When I first studied them, there were four families, but now the partridges and quails, which I learned to consider as members of the Perdicidae, are lumped with the pheasants in the Family Phasianidae. This makes one less family name that the serious ornithologist has to learn. The members of the group here considered all belong to the Order Galliformes, from which we get the common designation of gallinaceous birds. The three families into which these birds are divided are the Tetraonidae, which includes the grouse, ptarmigans, prairie chickens and sage hens; the Phasianidae, which includes the quail and pheasants; the Meleagrididae, which includes the turkeys. If you wish to find more about this classification, I would refer you to the Check-list of North American Birds, issued by the American Ornithologists' Union.

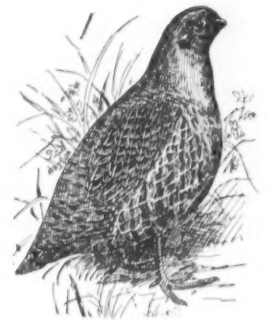
One reason why we decided to consider these birds at this time is that the National Wildlife Federation, which sponsors National Wildlife Week, has elected this year to devote special consideration to the plight of the prairie chicken. It would seem that the most intelligent cooperation in any campaign of this sort would come from an enlightened public that has been provided with some information about the problem at hand, rather than to ask support of a project on a wholly emotional basis. Last year the Federation called attention to the plight of the key deer. This year it is the prairie chicken. We hope we can cooperate with the Federation, and with other agencies next year, in informing the public as to threats toward some other form of wildlife.

One must not assume that because the birds here presented are considered as game birds by those who hunt them, that they have no other merits. The voters of Iowa and of Ohio have, in the past at least, recognized

RUFFED GROUSE

SOOTY GROUSE

SHARP-TAILED GROUSE



HUNGARIAN PARTRIDGE

the bobwhite as a song bird, and gave it complete legal protection. Anyone who has lived a part of his life in a region where bobwhites call from nearby fenceposts, and another part of his life where the bird and its voice are absent, will recognize that the bird has something to offer society besides a target and a half-dozen ounces of flesh and feathers. The worst we could wish those who might differ from us on this is that they be doomed to live the rest of their lives without hearing a bobwhite on a bright spring morning, seeing a covey of little bobwhites run across the path on a summer afternoon, flush a covey of the birds at the edge of a grain field when autumn colors are at their best, or in winter spot a dozen of the birds forming a circle, back to back in the snow, under some overhanging cover. Not one of these experiences is academic to me but is based on observations when I moved from central New York to Iowa forty years ago. Through all that time, I have resented the memory of a faculty colleague who, when shown a covey nestled closely together in a snow bank, backed off and with one shot wiped out the whole family. I never went into the field with him again. And others who witnessed the event ostracized him from then on.

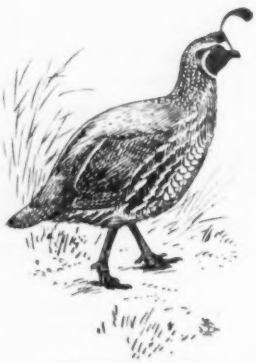
There is little doubt but that, with birds of this group given adequate cover and food, and protection when needed, there may well be a harvestable surplus. A Hungarian partridge that lays eighteen eggs, a pheasant that lays a dozen, and a bobwhite that lays to twenty-eight eggs, has a tremendous recuperative capacity. And the fact that bobwhite populations are frequently highest where the population of foxes is also high shows us that under natural conditions these birds can maintain themselves. But there must be land practices that recognize the needs and values of wildlife.

The situation of the prairie chicken has undoubtedly been complicated by the high price of farm products. Land owners have aimed all their efforts at the production of cash crops. Lands that in a less favorable economic period were left neglected have been plowed up and made to produce crops. The result has been that adequate natural territory for this species to carry on its usual life cycle has been cut, and cut, and cut. It is a part of the function of conservation education to show the land owner how, by certain practices, these cuts may be made less severe.

DUSKY GROUSE

CHUKAR

BOBWHITE QUAIL



VALLEY QUAIL

If you have the opportunity, read that superb book, *The Prairie Chicken in Missouri*, by Charles W. Schwartz, published by the Conservation Commission of the State of Missouri in 1944. You will then appreciate that, for this species to survive, it is probably essential that extensive areas be left in which the birds may nest, rear their young, and escape their enemies in winter, and be adequate in numbers to stand gunning pressure. This means a rather permanent cover at least six inches high and of sufficient extent to support the number of birds that make up a normal flock.

Many of the birds we are here considering may give a false impression of their abundance. Species that flock at any time of the year easily may do this, but the size of these flocks gives us some idea of the status of the population of a species. Where, not many years ago, California quail used to appear in flocks of a thousand or more, now they appear more commonly in flocks of a hundred or less. Possibly one of the reasons may be that about the time the Gold Rush reached its climax market hunters used to *average* 10,000 quail per hunter per year. That may be the factor accounting for the decline, or the real reason may be the piping of water for irrigation and domestic use so that it is unavailable in the breeding area, or the intensive cultivation of the ground in such a manner that the birds cannot find suitable food or cover throughout the year. The combination of these three factors, plus continued shooting, make it difficult for any organism to survive.

It is to the credit of true sportsmen and wise farmers that efforts are being made to restore suitable cover for many kinds of "game" birds. If these groups can live up to their highest ideals, we can have some faith in the future. Unfortunately, all sportsmen and all farmers do not have the intelligence of the more farsighted.

The first time I was in the Mount Rainier region I remember a tourist trying desperately to get the park naturalist to agree that Paradise Valley could be improved by the introduction of the native flora of the Alps. I was glad to come to the naturalist's assistance and defend the exclusion of exotic plants from the area. This is a perennial problem with anyone charged with the protection of natural areas, whether it be my little woodlot

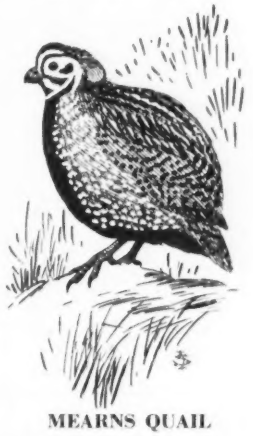
across the street from my home or a project of the Nature Conservancy, the Wilderness Society, or the National Park Service. The same problem arises with respect to our "game" birds. We have introduced into our outdoors the ringneck pheasant, Hungarian partridge, Chukar partridge, and, to a lesser degree, some other species. The ringnecks have established themselves successfully in territory not fully occupied by the native species. With cultivation of the ground, prairie chickens moved out and the pheasants moved in. In the Northwest and the grain fields of southwestern Canada, the Hungarian partridge seems to have done well. In a few western states like California, Washington and Minnesota the beautiful Chukar partridge seems to show signs of maintaining itself, but in eastern states like New York, Ohio, Virginia, Pennsylvania and Rhode Island it seems to have failed completely. Perhaps some justification for introduction of Chukar lies in the fact that it seems to be able to survive in dry, almost desert conditions that do not adequately support native species. The United States Fish and Wildlife Service seems to be trying to find a sensible solution to the question of the introduction of exotic game birds into America. Possibly the best results have been in getting data to prove that it would be unwise even to try to do some of the things proposed by some of our citizens.

Much effort and money has been spent in trying to maintain the game bird population by rearing the birds in captivity and freeing them for harvest. This often has been little more than wild animal husbandry, and, as time has gone on, it has been found that it usually is much more efficient so to manage the environment that the birds will take care of their own maintenance.

A quick glance at the tabular material in this insert reveals that the birds we are considering vary considerably in the type of country they occupy. In the woodlands, we find the turkeys and the grouse holding sway; in the open fields, it is the realm of the quail, ptarmigan, prairie chicken and sage hens. Even these major areas are easily subdivided. The turkeys, for the most part, have been driven into the heavily forested areas. The ruffed grouse takes over in the woodlands of mixed hardwoods and conifers. The spruce grouse, dusky grouse and sooty grouse are at their best in the evergreen country, and even these birds have their preferences as to dry and wet woodlands, and to lowlands and high mountainous country. We have suggested that pheasants favor the vicinity of country raising corn and cereals. Look for yourself in the fields, if possible, or in the tabular text to find which of our birds favor desert lands, grasslands, and so on.

SCALED QUAIL

MOUNTAIN QUAIL



MEARNS QUAIL

All of these birds are closely related to our domestic poultry. Some of them may, as chicks, be incubated in incubators and brooded by commercial brooders or by domestic poultry. The pheasants probably seem to have yielded most readily to this type of semi-domestication without losing their wildness when they are freed. Attempts to rear many of these birds have failed because of the fact that they are subject to the same diseases that insure domestic birds and do not share their resistance to these troubles. The whole industry of domestic turkey raising was revolutionized when we took to rearing turkeys on wire off the ground, thus preventing the birds from contracting troubles that had their source in ground polluted by our domestic birds. Adapting this technique to the rearing of ruffed grouse yielded results, and while it is now known how to rear these birds in captivity through a number of generations, it does not seem sound economics to solve the problem in this way.

Probably there is no group of birds that provides us with more interest than do these birds during their courtship period. The general pattern seems to be for the birds to be polygamous. In the case of the prairie chicken a few cocks may win all the honors, but this requires a congregation of a large number of birds of both sexes in a relatively limited area. As is usually the case where polygamy prevails, the male takes little responsibility for the family after the mating period. With the bobwhites, however, a pair of birds may remain together for nearly a year, with both adults assuming some responsibility for the family.

With some of these birds, there is a distinct tendency toward segregation of the sexes as maturity approaches. The courtship behavior, of course, varies, with the bobwhites possibly offering the simplest technique and the prairie chickens the most complicated. Even though the bobwhites may approach monogamy, the males have to rewin their mates with the approach of the breeding time. This is probably as it should be for domestic harmony. Associated with the breeding period, of course, are the sounds produced by these birds. These vary from the rooster-like crowing of the pheasants, and the gobbling of the turkey, (Continued on page 256)

NAME SCIENTIFIC NAME	DUSKY GROUSE *Dendragapus obscurus*	SOOTY GROUSE *Dendragapus fuliginosus*	SPRUCE GROUSE *Canachites canadensis*	RUFFED GROUSE *Bonasa umbellus*
DESCRIPTION	Length, cock bird, to 21 inches; hen, to 18 inches. General appearance, dark gray to blackish grouse with light border on tip of tail. Cock, dusky, with yellow or orange patches over eyes.	Length, 16 to 19 inches. Conspicuous as a dark gray fir-forest grouse of the Northwest. Shows a light band at the tip of the tail. Sometimes appears in flight to be an almost black grouse. Hen is browner than the cock and might be confused with a Ruffed Grouse except that it has a gray cast rather than a rusty one.	Length, to 17 inches, slightly smaller than Ruffed Grouse. Legs, feathered to toes, while lower tarsus of Ruffed Grouse is bare. Above is barred black, gray and brown. Underparts have black feathers tipped with white. Skin above eyes is red. Hen paler than cock and underparts barred. Tail, composed of 16 feathers, which have a wide orange brown band at end.	Cock, to 19 inches long with wingspread to 25 inches and tail to 7 inches. Weight, to 29 ounces. Buff to mahogany, spotted with gray above. Underparts, lighter buff being lightly barred on breast and heavily barred with dark on the flanks. A conspicuous ruff on the neck of the cock and a well defined crest on the head. In winter toes may be heavily "feathered."
RANGE AND RELATIONSHIP	Order Galliformes. Family Tetraonidae. Six subspecies include Dusky, of Utah, Idaho, Colorado, New Mexico and Nevada and Arizona; Richardson's, of British Columbia, Alberta, Oregon, Idaho and Wyoming; Sierra, of Washington, Oregon and California and Mt. Pinos, of California as well as the Canadian Sitka and Fleming's Grouse.	Order Galliformes. Family Tetraonidae. There were 4 subspecies; the Sooty, the Sierra, the Sitka and the Mount Pinos Grouse, but field differences are negligible. All from evergreen forested areas of Pacific Northwest, ranging from Washington to southern California (the Mt. Pinos subspecies), but are not found in eastern Cascades of Washington and Oregon.	Order Galliformes. Family Tetraonidae. Four subspecies recognized, including Hudsonian from eastern Rocky Mountains in Alberta to Labrador Peninsula; the Canada from southern Manitoba to New Brunswick and south through Wisconsin, Michigan, New York, New England and Nova Scotia; the Alaska and the Valdez, both of Alaska.	Order Galliformes. Family Tetraonidae. Five subspecies recognized, including the Eastern of Minnesota to southern Ontario and New York and south to Kansas and Georgia formerly; the Canada from northern Quebec and Maine through northern New England, New York to Minnesota; the Gray from S.D. to Colo. and Utah to B.C.; the Yukon and the Oregon.
HABITS	Cocks may weigh to 3½ pounds, making them largest of woodland grouse. Cocks may fight over hen, displaying inflated neck sacs and booming a challenge. Nest not well hidden on ground, with 7 to 10 creamy buff eggs speckled with reddish-brown spots. Incubation about 3 weeks by hen alone. Young able to move about actively soon after hatching.	In courtship or challenge the male gives a series of 6 or 7 low, muffled booms sounding about an octave below the hoot of a horned owl and being highly ventriloquial. Nest is on ground slightly lined with vegetation. Males may battle over a hen. Eggs number under a dozen and are incubated by hen about 3 weeks. Young are able to run about soon after being hatched.	Cocks strut and flutter before female in courtship antics. One cock may win number of hens. Breeds chiefly in swampy, evergreen forested lands. Nest, on ground in depression usually under cover. Eggs, 8 to 16 variably buffy with brown and purple spots, 1-2/3 by 1-1/5 inches. Incubation by hen for 17 days. Chicks able to run soon after hatching.	Cock, courts by strutting before hen drumming on log. One cock may mate with several hens. Nests well hidden in depression on ground. Eggs, 8 to 14, pale brown, 1½ by 1¼ inches. Incubated 21 to 23 days by hen. Young able to run when hatched or immediately after. Hen provides protection through summer. One annual brood.
FOOD	Food is largely buds of evergreens, berries and other vegetable foods available in environment. In winter, may keep to tops of tall evergreens getting food there from the tree buds. The name Fool Hen is applied to the Dusky Grouse, but it is not always appropriate, since bird may become wily if molested too much.	In courtship male displays inflated air sac on each side of neck with surrounding feathers being extended outward. Head is held downward at beginning of booming sound. Sooty Grouse and Dusky Grouse are not so clever as Ruffed Grouse in concealing nest, and both come rather rightly by common name Fool Hen.	Food in summer largely small fruits and insects including crickets and grasshoppers; in winter dried fruits, buds and needles of spruce, larch and fir and other evergreens. Belongs with the Fool Hen group because where not annoyed may become insensible to danger and may be approached with ease by its many enemies.	Food acorns, nuts, tree buds, green leaves, fruits and seeds. Young guided but not fed by hen. Subject to many diseases of poultry, and when reared in captivity are kept off ground except that courtship is stimulated by being temporarily on the ground. Brood together through first winter ranging over 40 acres of land. Flight speed to 55 feet per second.
ECONOMIC IMPORTANCE	A suitable "game" bird of its territory, and in some situations a valuable food for lost persons, who on occasion may kill them with a stick. It is interesting to the nature enthusiast. Called Blue Grouse, Gray G., Mountain G., Pine G., Pine Hen.	A bird of relatively limited distribution in the United States, likely to survive so long as suitable cover is available and adequate protection is afforded, but likely to disappear if these fail. Its high mountain haunt may delay extinction.	In winter flesh is unpalatable largely because of the food eaten by the bird. Larches and fir can hardly produce superior flesh. Bird may be of value as emergency food for lost travelers and surely is deserving of more protection than it gets. Among its common names are Black Grouse, Wood Grouse, Cedar Grouse, Spotted Grouse and Swamp Partridge.	One of finest woodland birds, which has survived heavy inroads on natural habitat. Where over-hunted becomes shy. Peak populations every 10½ years. Habitat management probably best practice. Pennsylvania's state bird.

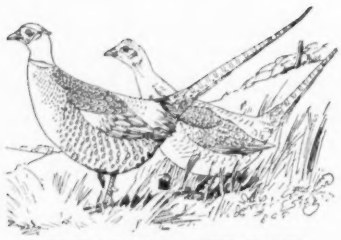
WHITE-TAILED PTARMIGAN *Lagopus leucurus*	PINNATED GROUSE (PRAIRIE CHICKEN) *Tympanuchus cupido*	SHARP-TAILED GROUSE *Pediocetes phasianellus*	SAGE HEN *Centrocercus urophasianus*	HUNGARIAN PARTRIDGE *Perdix perdix*
Length, to 13 inches being smallest ptarmigan. In summer, adults have neck, back, head and breast marked with gray, brown and white, with tail and most of wings and lower breast pure white or dark flecked, with much variation in individuals. In winter adults are pure white with bill alone appearing black. Young all white except for grayish tail.	Length, to 18 inches, or about the length of the Ruffed Grouse. Tail, to 4½ inches. Weight, to 2 pounds. Sexes, about equal in size, barred brown in general. Cock, with inflatable air sac on neck, bordered by long tufts of feathers, which, in courtship, are erected exposing the orange yellow sacs. Cock also has erectable spots over eyes. Temperature, about 109°F.	Length, to 20 inches. Differs from Pinnated G. by having longer spiked middle tail feathers. Both are considered as Prairie Chickens. Head and neck, buff with white streak behind eye. Upper parts brown marked and barred heavily with black. Breast, marked with black Vs and throat light brown. Sexes similar but cocks have orange, inflatable air sacs on side of neck.	Length, cock bird to 30 inches, weight to 8 pounds. Hen, to 23 inches. Cock, conspicuous because of spike-like tail feathers and contrasting black belly Shoulders, with black wiry plumes and downy white feathers. Distensible yellow air sacs on side of neck. Legs, feathered. Chest band, blackish with wiry feathers. Hen, smaller without ruffs. Belly, brown.	Length, to 14 inches. Weight, to 15 ounces. Cock, slightly heavier than hen. Appears about 1½ times as large as Bobwhite. Upper parts including head, neck, shoulders, back, tail and breast are shades of gray, but back is brownish-gray. Wings, brown with whitish lines. Flanks, pale gray with chocolate splotches. Dusky horseshoe patch on breast. Red phase rare.
Order Galliformes. Family Tetraonidae. Five subspecies recognized, the Vancouver, the Kenai and Rainier of limited range, the Northern ranging from northern British Columbia and central Alberta to Vancouver Island and the more widely distributed Southern White-tailed, which ranges tnrough the Rocky Mountains, Mont. to north N.M.	Order Galliformes. Family Tetraonidae. Three subspecies, including the extinct Heath Hen, the Greater Prairie Chicken of west-central Alberta, southeastern Saskatchewan and southern Manitoba to Colorado, Arkansas, Missouri and Illinois and even into Ohio, Kentucky and once possibly into Pennsylvania, and the Attwater Prairie Chicken of Texas and Louisiana.	Order Galliformes. Family Tetraonidae. Three subspecies include the Northern of central Alaska to Ungava and south to Lake Superior and Quebec; the Columbian from British Columbia to northeastern California, Utah, Colorado and New Mexico and the Prairie from southern Alberta and Manitoba to Wyoming, Neb., S.D., Minn., Kan. to Ill.	Order Galliformes. Family Tetraonidae. A single species with no subspecies ranging formerly from British Columbia southern Saskatchewan and northwestern North Dakota south to northwestern Nebraska, northwest New Mexico and middle-eastern California. It is a bird of the sagebrush plains of the Transition Zone, shunning forested lands.	Order Galliformes. Family Phasianidae. Originated in central Europe and native of Sweden, Germany, British Isles, France, Switzerland and the Pyrenees. Introduced into America about 1899. Reasonably established in wheatbelt of southwestern Canada in provinces of British Columbia, Saskatchewan and Alberta, also in Wash., Wis., Ore., Ida., Mont., Ill., Minn.
Nest is found on ground in a depression, either bare and exposed or with some grass lining and construction, sometimes with a few feathers added. Eggs 8 to 15, dull cream-colored to pale red, generally somewhat heavily marked with brown. Nesting period is early summer, and there is one annual brood. Incubation is by the hen for 26 days but cock stays by.	Many males hold courtship powwow, stamping, bowing, inflating air sacs and giving loud booming sounds and fighting other cocks so that eventually a few cocks win many hens. Nest is in small depression sheltered by grass. Eggs, 10 to 14, sometimes speckled, 1-3/5 to 1¼ inches. Incubation by hen for 23 days. Cock ignores family. Young mature first winter.	Males court females, which congregate in flocks of to 100 or more. Great bowing, scraping, stamping and fluffing of feathers with repeated rumbling "cac, cac". Nest on ground in a depression with little or no lining. Eggs, 11 to 14, cream-brown to pale olive with spots of reddish brown sometimes, 1-3/5 by 1-1/5 inches. Hen well protected by coloration.	Mating period ends in May. As many as a hundred males may congregate and engage in a dance involving foot stamping, drumming, croaking. A few cocks win many hens. Courtship antics usually at dawn or dusk. Males may reach height of ardor in February. Nest on ground, with 7 to 9 dull eggs attended only by hen, incubated 3 weeks.	Males fight viciously in breeding season but do not assist in incubation or in rearing of young. Pair in January. Nest in April or May. Eggs, 6-18, olive-green or blue, somewhat pointed, weigh 26 g., plain. Incubation, 21-26 days, with cock acting as guard but not a participant. Young run soon after hatching, begin feeding on insects. Young molts to adult plumage in early fall.
Food largely plant material, including buds of trees, wild fruits such as blueberry and vetch and many tree fruits. Also included in season are insects and other small invertebrates that happen to be available. Excessive grazing by sheep nave and will reduce the range in which young will be raised and reduce the species.	Food largely (86%) vegetable matter such as grain, acorns, fruit and berries and most of the remainder of insects particularly in the summer and when young. In winter flocks of one or another sex may form and there may be some migration. Almost wholly dependent on cover at least 6 inches high for food and shelter. Needs much better protection from hunting.	Food grains such as wheat and oats, also sunflower seeds, buckwheat and buds of tamarack and flower clusters of birch with some grecn vegetation. Gravel must be available for use in crop. Supports a number of intestinal parasites and serves as food for a number of predatory animals. Needs suitable cover and better protection from hunters to survive.	Family of hen and chicks remain together until fall, when sexes separate. Food largely sage brush. Water requirements of a minimum nature. While there is large congregation of numbers in the fall there is little major migration in the seasons. Young may feed largely on insects and grains. Gizzard is lacking so gravel is not important in digestion.	Food consists of grain and of insects, the latter including grasshoppers, locusts and potato bugs. Chicks feed abundantly on ants. Plant food includes leaves of clover, millet, wheat, cabbage, grain and many kinds of berries. Estimated 40.5% insects, including 23% of total harmful species; 50% plant material, with only 3.5% grain. Speed 53 m.p.h.
A useful, interesting bird but doomed to extinction if upland grazing is not managed with some intelligence. The birds may have food value to man in survival situations. Related ptarmigan include the Rock Ptarmigan and the Willow Ptarmigan, the former being western and the latter being essentially eastern.	National Wildlife Federation, in 1953, is emphasizing a program to give protection to this valuable bird by calling attention to great reduction in numbers and threat that goes with intensive cultivation of former range lands. Has periodic abundance and scarcity somewhat like that of Ruffed Grouse. May live in woodlands but does not prosper there.	A useful bird doomed to extermination unless abandonment of farming lands restores sufficient territory of a suitable nature before the populations reach the critical stage. Has shown some increase in parts of its range. There is a cycle of abundance and scarcity and some migration. Called Spike Tail, Black Foot, Waite Grouse, Willow G., White bellied G.	Interesting game birds but almost hopeless as a source of food, particularly as adults, having fed almost exclusively on sage, are unpalatable and tough. Young birds having fed on grain, berries and fruits may be considered as reasonably good eating. Called Sage Cock, Cock of the Plains.	In Europe is shot by thousands by men who drive them over hurdles making them fly to be shot by hunters sitting comfortably handy. White Leghorns have been suggested as a more conspicuous substitute. May replace the vanishing Prairie Chicken, or relieve pressure on them. Popularly called Hun.

NAME SCIENTIFIC NAME	CHUKAR PARTRIDGE *Cacabis chukar*	BOB-WHITE *Colinus virginianus*	SCALED QUAIL *Callipepla squamata*	VALLEY QUAIL *Lophortyx californica*
DESCRIPTION	Length, about 15 inches. Upper parts of male, slaty or pale blue, irregularly streaked with buff. Wing-feathers light brown tipped or bordered. Underparts, almost white, but sides with broad black bands. A black band extends through eye down side of neck and joins at lower throat. Face below this line and throat white. Bill, feet and legs vermilion.	Length, to 11 inches, with 16-inch wingspread. Weight, to 9 ounces but average from 5 to 6 ounces. Tail, short. Lower breast, with blackish bars or U-shaped marks. Conspicuous white throat and with whitish band across side of head and through eye. In the hen this band is buff. The black on the head of the cock is replaced with brown in the hen.	Length, 1 foot. Tail, to 4½ inches. Adults closely resemble each other. Pale bluish-gray and dull brown. Neck, shoulders, breast and belly appear scaled because of dark-tipped whitish feathers. Sides, white-streaked. Short white-tipped crest and dark bordered yellowish cheek patch. Crest of young, brownish.	Length, 9 to 10 inches. In California, quail cock is deep ashy-brown above with rusty brown stripes on sides of back and with olive-brown sides white streaked. Slate-gray below with scale-like markings and a brown patch. Head, conspicuously black and white lined with curved crest. Hen lacks conspicuous head markings, being mottled olive-gray and white.
RANGE AND RELATIONSHIP	Order Galliformes. Family Phasianidae. The form introduced into America was native of the foothills of the Himalayas but other forms are being experimented with to get birds that will survive in areas not now occupied by native species. Close relatives include the Greek, the Barbary, the Arabian and the Smyrna partridges. Most successful introduction is in Cal.	Order Galliformes. Family Phasianidae. Five subspecies include the Eastern that ranges through eastern North America from South Dakota to southern Ontario and southwest Maine and south to northern Florida and Texas; the Florida from much of Florida, the Key West now extinct; the Texas, from Washington to Texas and northern Cal. and the Masked.	Order Galliformes. Family Phasianidae. Two subspecies, the Arizona and the Chestnut-bellied Scale Quails, the former ranging from western Texas, western Oklahoma and Southern Colorado through central Arizona and New Mexico and into northern Sonora and northern Chihuahua; the latter more restricted to southern Texas and northern Mexico.	Order Galliformes. Family Phasianidae. Five subspecies recognized: California, ranging from Vancouver Island to Monterey, California; Valley, ranging from Upper Klamath Lake to Nevada and throughout California; Catalina, found on Catalina Island; San Quentin between lat. 30° and 32° from Pacific Coast east to Sierra San Pedro Martir, and San Lucas Quail.
HABITS	Seems to be able to survive on drier areas than some related species. Some success in introductions in Minnesota, Nevada, Nebraska, North Dakota and Washington. Failures seem to have been in eastern and southern states where introductions have been tried. Do not have data on reproductive habits of this species.	May keep mates over 1 year, though cocks fight at beginning of breeding season. Cock builds nest on ground, though several pairs may use common nest. Eggs, 7 to 28, white, about 1 by 1-1/5 inch, weighing 18 grams. Incubation by hen and cock for 23-24 days with an average hatch of 86%. Young leave nest immediately after hatching and are cared for by both parents.	Nest on ground, often under bush or in grain field, with coarse grass lining. Eggs, 12 to 16, cream colored with regularly distributed buff markings, lusterless, thick-shelled. Incubation period, 21 days. One annual brood but a relatively long season required for rearing that family, in which mortality is high. Both adults assist in rearing young.	Nests on ground, in depression with vegetation border. Eggs, 12 to 17, creamy white with brown and lavender spots. Incubation, for 21 to 23 days with both parents participating. Breeding season begins in March, with breakup of last year's covey when males begin calling "ku kwak up" repeatedly. Nests rarely to 10 feet above ground. Young run soon after hatching.
FOOD	Chukars seem to have adapted themselves to a wide range of habitats. Possible that successful introductions may depend more on habitat management than on other factors. May be that given similar amount of time to become acclimated that Chukar may equal Ring-necked Pheasant and Hungarian Partridge as successfully introduced bird to relieve natives.	Food to 86% vegetable matter, or, in season, injurious insects such as grasshoppers, June beetles, chinch bugs, potato beetles, squash bugs. In winter, food may be largely weed seeds and waste grain. Winter coveys of less than 10 birds are unlikely to survive severe conditions. Coveys crowd together tail to tail. Individual range about 1 sq. mile. Speed 50 m.p.h.	About ¾ of the food is vegetable matter of which ½ is seeds including pigweed, buffalo burr, oats, wheat, kafir corn, cactus, sage and mesquite, also leaves and sprouts of plants and fruits (about 4%) of mistletoe, juniper, tomatilla and cactus. Insects (about 25%) include grasshoppers, beetles, scale insects. Can survive on dew and plant water.	Flight to 80 feet per second. May get water from dew or fly to drinking place daily. Food may be to 98% vegetable matter, with emphasis on fruit, though most important food probably is bur clover and alfilaria. May eat waste grain and quantities of weed seeds. Enemies include foxes, cats, skunks, weasels, horned owls, Cooper's hawks, coyotes, bobcats.
ECONOMIC IMPORTANCE	There is every reason to expect that this will be sometimes considered an outstanding game bird, although its beauty may win it defenders among those who respect beauty. However the efforts aimed at the introduction are being supported almost wholly by those who seek its establishment as a game species.	In some States such as Iowa and Ohio Bobwhite has been considered by legislation to be a song bird. Its abundance is based usually on cover conditions and may be most abundant in areas boasting high populations of foxes. Is State bird of Oklahoma and Rhode Island. Call *Bob* 1,6545 c.p.s., *white*, 2,742 c.p.s.	Food more largely insects than in bobwhite. May become attached to a particular area and become tame as pets. Because of this habit it is popular. Some winter migration.	In 1860, average market hunter shipped about 10,000 of these quail a year to market. Thousands of quail used to congregate but now 100 is a large flock. May destroy some fruit by pecking it. Has yielded to management practice; hen under management may lay to 70 eggs a season. Tremendous recuperative capacity. Considered as a "game" bird as once were robins.

GAMBEL QUAIL *Lophortyx gambeli*	MOUNTAIN QUAIL *Oreortyx picta*	MEARNS QUAIL *Cyrtonyx montezumae*	RINGNECK PHEASANT *Phasianus colchicus*	WILD TURKEY *Meleagris gallopavo*
Length, to 10 inches. Tail, to 4½ inches. Adult male, with black 1½-inch recurved plume on top of head, with black patch on buff belly, brown flanks streaked with white, reddish-brown crown and throat and forehead with black and white border. Hen, with 1-inch crest and belly uniformly buff without the black patch of the cock and black and white on head.	Length, to about 1 foot, with sexes closely alike. Upper parts, olive-brown and slatish-gray beneath. Sides with wide black and white bands. Plume on top of head usually of two 2-inch black feathers that may stand erect. Throat and upper breast, orange-brown with narrow black border with further white border. Region back of beak white. Black near eyes.	Length on average 9 inches for both sexes. Feet large with powerful claws. Tail remarkably short and obscure. Cock with pale brown back streaked with white; sides slaty gray with white spots; middle underparts dark brown and black. Legs and feet blue-gray. Head patterned with black, white with fawn colored small crest. Hen less conspicuously marked.	Length, to 3 feet, 1/3 of which in the cock is the tail. Hen, about 20 inches long. Male, with strong spurs, brilliant coloration including a white collar and ear tufts. Cock, burnished reddish-brown to chestnut, forming a finely checkered pattern. Wattles vary in season. Hen, brownish to chestnut and less conspicuous than the cock. Weight, to 4½ pounds.	Length, to 50 inches. Weight, to 40 pounds. The male, a gobbler is a burnished chestnut and black with banded tail, conspicuous wattles and a breast tuft of hair-like structures. Normally gobbler weighs about 20 pounds and hen half as much. Differ from domestic turkey in having chestnut instead of white tips to tail feathers and wing coverts.
Order Galliformes. Family Phasianidae. Two subspecies, the Gambel, ranging from southern California, southern Nevada, southwestern Utah, Arizona, and the El Paso region of Texas into northeastern Lower California and Guaymas, Sonora, Mexico; the Olathe Quail of southwestern Colorado. In the Olathe cock, the upper parts are gray and the lower parts buffy.	Order Galliformes. Family Phasianidae. Three subspecies include the Mountain Quail, ranging from southwestern Washington and Vancouver Island to Monterey County, California; the Plumed Quail from the west side of Cascade range in northwest Oregon to the Mexican line and desert area of extreme western Nevada; the San Pedro Quail of the Sierra Juarez.	Order Galliformes. Family Phasianidae. But one species but with closely allied races to the south. Ranges from central Arizona, central Texas and central New Mexico south into Mexico in mountains of northern Coahuila, Chihuahua and eastern Sonora. Is found for most part in arid lands and in mountainous country. Summer range in New Mexico at 5000 to 8000 ft.	Order Galliformes. Family Phasianidae. Native of eastern China from Canton to the Yangtze. Four races were introduced, these have mingled and crossed to form the bird of our fields and woods. Particularly established in grain-yielding areas of Iowa, Minnesota and the Dakotas. Also is established in England and other countries.	Order Galliformes. Family Meleagrididae. Four subspecies include the Eastern, which ranged from Pennsylvania to Kansas and south to Florida and Texas, formerly through New England and into Ontario; the Florida, found north to Gainesville; the Rio Grande of middle Texas and northern Mexico; the Merriam from southern Colorado through New Mexico and Ariz.
In a long breeding season resulting usually in two annual broods beginning in April and July the nest is on the ground in a grass-lined or bare depression. Eggs, 8 to 12, white or buffy brown with purple and brown spots. Incubation, for 21 to 24 days with the chicks able to run soon after hatching, but needing and getting parental care for about 2 weeks.	In courtship, the cock crows like a bantam rooster, or gives bob-white-like "quit, quit, queah." Nest is on ground surrounded by vegetation, or under bushes. There are from 6 to 12 eggs in a clutch. They measure from 1-1/3 inches, are rather pointed, light buff, usually unmarked or stained brown from leaves. The breeding season in Cal. early April through Aug.	Nest is in a depression, well lined with vegetation, partly hidden by surrounding grasses, or may be a bulky mass of grass resembling a rat's nest with but one entrance, which is small. Eggs, white and usually 8 to 12. Incubation, probably about 3 weeks and but one brood per season. In breeding season, call is low and quavering like that of a screech owl.	Cocks fight for hens, maintaining considerable harem of as many as 7 hens. May fight domestic roosters in breeding season. Gives high pitched crow. Nest in grasses, grain or other vegetation made by hen. Eggs, 6 to 12, olive-buff, 1-2/3 by 1-1/3 inches, incubated only for 23 days. Young cared for by hen until fall when molt takes place and sex differences obvious.	Gobbler maintains a harem of to 15 hens for which he fights rivals. Gobbler does not help hen in nest building, incubation or young-rearing. Nest carefully hidden on ground with 10 to 14 eggs that are pale buff or brown speckled, 2 by 2¾ inches. Incubation 28 days. Young do not eat for 2 days but run soon. Two hens may combine flocks. Others may join later.
Food in winter and spring mostly vegetable matter, mistletoe fruits, mesquite leaves, cactus fruits and many weeds in various stages of development. Insects may include grasshoppers, ants, stink bugs, scale insects and plant lice. As much as 90% of the food may be plant matter, of which the evergreen hackberry provides an important part.	Food, if in agricultural areas, is wheat, corn and barley totalling about 97% and remaining 3% is almost wholly insects. Cannot live on succulent plant material alone. Since it requires drinking water its range may be limited by availability of water. May be found close to rushing mountain streams and with taking of water into conduits may vanish from territory.	Greatest percentage of food is vegetable matter, including grass seeds and wild berries. May be unusually wild, but individuals may be exceptionally tame. When excited may spread its crest instead of raising it, as do most of its relatives. May sit close until almost stepped on. Because of this has been called Fool Quail. Flocks are small and rarely exceed a dozen in number.	Food includes both plant and animal matter, with roughly about twice as much plant matter as animal. Includes grain, fruits, acorns and the like with some green matter. Destroys great numbers of grasshoppers in season. May drive other game birds from territory. Middle West population averages 1 bird per acre.	Food largely seeds and vegetable matter including acorns, nuts, grains and weed seeds, with insects in season. Has learned to be one of the most cautious and shy of game birds, but may be called to hunter's or photographers' stands. Was reported in early days to be pests in New York State but is now gone forever. Increasing in some areas.
Known as Desert Quail by some writers. Its flight is estimated at from 50 to 60 ft. per second or about 50 miles per hour being slower than the California Quail and Bobwhite. Enemies are coyotes, foxes, snakes, man and the usual predators of its habitat. Habit of forming large flocks for a few weeks in fall has its disadvantages to the species. Called Desert Quail.	In northern range, may migrate with the seasons into milder areas if the season is rugged. The region of greatest abundance is probably California where it is hunted at altitudes of between 5000 and 10,000 feet. It is a bird prized alive by nature lovers generally.	Considered a "game" bird of limited possibilities. Cannot be considered as a pest because its habitat usually is unsuitable for agricultural development. Family life may be ideal with both sexes caring for the brood of the year. At these times may be a master of concealment tricks. Is rarely abundant anywhere but may be at its peak of abundance in western Texas.	Most important of our "game" birds. Was raised and freed from game farms but practices change and in the future it is more likely that management will consist primarily in cover management. Abundance may be determined largely by seasonal conditions during breeding and by severity of winter, also food. Called various names.	Possibly America's finest "game" bird and in the South in some areas is reasonably abundant and with wise management may be maintained and even increased. In Texas and some other states the annual take is managed to fit the available population and in some areas land owners may collect for privilege of making the harvest.

WILD TURKEY

GAMBEL QUAIL



RING-NECKED PHEASANT

(Continued from page 251)

through the whistled call of the bobwhite, to the booming of the prairie chickens and sage hens, and to the "drumming" by the rapid wing-beats of a courting ruffed grouse.

Much of man's interest in wildlife is associated with food problems. If a creature eats or destroys substances that are of food value to man, this habit leads to prejudiced judgment. Most of these birds do feed on grain when it is available. Quail may also feed on or injure grapes, and where injury affects the market value, this detracts from the popularity of the birds. However, most of these birds feed heavily on weed seeds and waste grain, and, during the season when the young are being reared, insects rank relatively high in the food list. This is the time when the birds need the insects and man needs to have the insect enemies of his crop destroyed, so everything works out well.

Man has a real interest in these birds because of their food value to him, but it is doubtful if the amount of meat harvested from these birds is justified economically when we consider the amount of money hunters spend on guns, ammunition, travel, special clothing, licenses, club dues and so on. It is claimed that the birds contribute to the health of many persons who find in field sports the opportunity for exercise they might not otherwise get. If we consider the value of the flesh of the birds as food to man, we would find in most species much to be desired. A grouse that has fed on evergreen buds, or a sage hen stuffed with sage, cannot compare with a turkey that has fed on beechnuts, or a pheasant that has become fat on good mid-West corn. Few of these can compare with a live bobwhite calling at the top of his lungs from a post near your window when you wake up on a spring morning, or a mother ruffed grouse trying to lead you away from her hiding chicks by appearing to have a broken wing. I have never been able to observe the courtship behavior of the prairie chicken, but from the moving pictures and the descriptions of my friends, I am sure that I would regret its extinction.

Part of the verve of living outdoors comes from experiences with these birds. This is true, whether we refer to the bombshell-like rise of a covey of quail, the stalking of a dumb fool hen, the excited chatter of a disturbed cock pheasant, the confidence in the value of protective coloration exhibited by an incubating ruffed grouse or the dainty behavior of any of our western quails. It seems as though we do know how to save these birds for all time. It would seem that we should have the sense to save them efficiently through the restoration of their environment, and wise restraint in shooting. Somehow, we must work out a plan where their varied appeal to a greater number of our public gets recognition. Working together we can still have what we now have in years to come. More than that, we can have things better than they now are. Such a program of improvement is worth fighting for, is worth sacrifices, and brings worthy rewards.

Perhaps, in this vein, we may take heed of *The Bible*, where, in Numbers, XI 31-33 we read:

"And there went forth a great wind from the Lord and brought quails from the sea, and let them fall by the camp. . .

"And the people stood up all that day and all that night and all the next day and they gathered the quails; he that gathered the least gathered ten homers (80 bushels) and they spread them all abroad for themselves round about the camp.

"And while the flesh was yet between their teeth ere it was chewed the wrath of the Lord was kindled against the people and the Lord smote the people with a very great plague."

There is a considerable library of books dealing with these birds, and ample opportunity for further study of them. Included on this list are such books as the following:

The Ring-Necked Pheasant and Its Management in North America. Edited by W. L. McAtee and published by the Wildlife Management, Washington, D.C. Distributed through the Stackpole Company, Harrisburg, Pa.

The Wild Turkey in Virginia. By Henry S. Mosby and Charles O. Handley. Published by the Commission of Game and Inland Fisheries, Richmond, Virginia.

Bobwhites on the Rise. By Verne E. Davison. Published by Charles Scribner's Sons, New York.

The Ruffed Grouse. By Frank C. Edminster. Published by The Macmillan Company, New York.

Grouse Feathers. By Burton L. Spiller. Illustrated by Lynn Bogue Hunt. The Macmillan Company, New York.

The Ruffed Grouse. By Henry Marion Hall. Illustrated by Ralph Ray. Oxford University Press. New York.

The Prairie Chicken in Missouri. By Charles W. Schwartz. Conservation Commission of Missouri, Jefferson City, Mo.

Life Histories of North American Wildfowl. Two volumes. By A. C. Bent. Smithsonian Institution, Wash., D.C.

A Plea for Private Property

DURING 1952, the number of violators of hunting and fishing laws in California topped all previous records. There were 7914 convictions, and fines totalling $292,000 were assessed. This represents an excellent effort at enforcement, although, of course, a great many violators got away without apprehension.

Were a comparable enforcement program carried on in every State, and the courts as cooperative as they are in California, a closely similar picture would be found everywhere.

During the recent sessions of the North American Wildlife Conference we talked with a number of men on the staffs of one or another State conservation or fish and game commission. We found the majority of them disturbed by the situation; some angry about it; others a bit mystified.

These officials have reason to be disturbed — and angry. There is no cause for mystification. It should be obvious that, with some fourteen million licensed gunners, the character and quality of those who go afield to shoot something is declining as the quantity climbs. And when we attended a meeting of the National Wildlife Federation, which mainly represents the forward-looking, conservation-minded sportsman, and heard several of the sportsman-delegates deplore the lack of conservation interest on the part of even the organized sportsman, the reason for the condition seemed more obvious.

There seems no doubt but that gunning as a sport is being over-sold. Rod and gun writers, only a few of whom seem to care about conservation, are avid salesmen. Fish and game commissions, most of whom depend entirely upon license sales for their existence, are over-selling. Hunting and fishing magazines, of course, continue to spread the word, and please the arms and ammunition advertiser. And a recent issue of *Collier's* carried an article entitled "Hunting in Your Own Backyard. You and a .22," which is typical of general appeal features that seek to promote the shooting of something the year around, and attract some advertising in the process.

The result of all this — plus movie, television and radio propaganda — is more and more incompetent, dangerous and ignorant licensees who never heard of conservation or sportsmanship, and who care nothing for the rights of private property. Which last brings us to a problem that is increasingly being brought to our attention from all over the country.

As these hordes of gunners take the field they encounter farms and woodlands posted with signs forbidding trespass and hunting. But they have equipped themselves with arms and ammunition, and, like, the gangster, feel the power that a lethal instrument provides. So they pay no attention to the signs, trespass where they choose, shoot what they want, and even threaten the property owner if he protests.

So people who have encountered such practices write in desperation to ask how they can protect their property and the wildlife on it; even their children, themselves and their domestic animals. They ask whether there is not some way in which their land can be declared a sanctuary, and cooperation of State authorities and the police obtained. The answer is, of course, that fish and game commissions do not want land closed to hunting and the licensees' opportunities to get a bag thus curtailed. The property owner is advised to police his own property, and take the violator into court.

We have before us documentary evidence of how this works. In one Ohio county, not far from one of the State's largest cities, farmers and other property owners got thoroughly sick of gunner trespass, shooting over their property from the highway, loss of domestic stock and bullets whistling across the barnyard. They gathered evidence and got a grand jury investigation — by a grand jury made up of gunners — and tried to get some protection. The jury returned no indictments, and the county prosecutor advised against swearing out warrants for individual arrests because the gunners would all stick together, deny everything, and, no doubt, sue for false arrest. And, in the process of the grand jury investigations, individual property owners were threatened with reprisals if they testified. Nor were the courts sympathetic.

With variations, but always with the same central theme, this condition exists in many places. The person who should be most concerned about it is the decent sportsman, the man who obeys the laws, shoots only at legal game in a legal manner, never invades a man's land without asking permission, and knows something about the problems of wildlife conservation. He is lumped with the trespasser; with the "city gunner" who has been sold on the joys of gunning, gotten himself a gun and ammunition, and gone out to be a nimrod, come what may.

At gatherings of sportsmen a good deal is said about education in decent behavior afield among those who find pleasure in the kill. Such education is attempted in some of the hunting magazines, and by State publications. This does not seem to reach the right people, certainly not the many being added annually by the over-selling now going on.

Whatever the case, the property owner has rights that he has reason to expect should be observed. He should have the cooperation of State authorities, local wardens, State police, local police and the courts, not the animosity that now so generally exists. And we do not believe that a legally created and State-defended sanctuary status for land, if the owner seeks it, would make much of a dent on the huntable area available. Indeed, such areas would provide wildlife reservoirs that might help in the face of heavy gunning pressures.

"The true conservationist is grateful. . .for endless beauty, inexhaustible occupation for the intellect, and a setting wherein he can find tranquility of spirit."

The True Conservationist

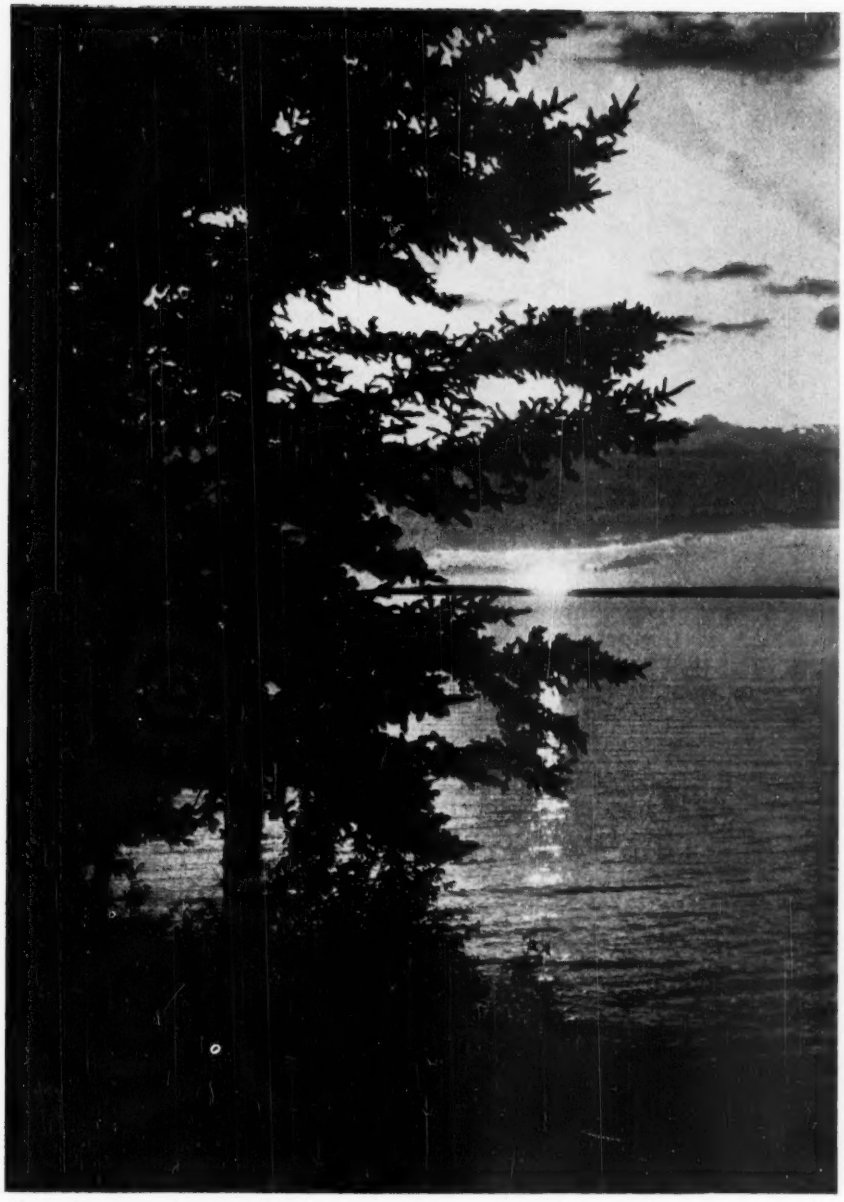
By ALEXANDER F. SKUTCH

WITHIN the short space of two generations, conservation has become popular. It receives growing publicity, is much in the public eye, is beginning to claim the allegiance of wealth and power. Accordingly, it faces the dangers peculiar to a successful cause. Half a century ago, when conservationists were few and fought a seemingly hopeless battle against powerful financial interests, greed, and popular apathy, they could at least be sure of the sincerity of those who fought under their banner. No one was likely to become an active conservationist for the material advantages it would bring him. Today, when conservation is supported by strong organizations and can offer lucrative posts, its ranks are in danger of being weakened by. . .

". . .such as for their bellies sake
Creep and intrude, and climb into the fold."

As the first enthusiasm hardens into organization, spiritual dedication tends to cool into mere intellectual assent, while method takes the place of zeal. Such has been the history of every religion. In our own case, there is a perilous tendency to regard conservation as a matter of technology, of hiring specialists to discover facts about Nature, and others to carry out their recommendations, rather than a peculiar attitude toward the natural world and a way of living. That is, it is infected with that blindness so widespread in our age, which believes that external arrangements can become an adequate substitute for internal soundness, governmental regulations for personal competence. It is led astray by the tragic fallacy that we can create a Utopia by remaking the physical world without first transforming ourselves; that we can improve society without regenerating men individually.

True conservation is above all an attitude of mind, and a way of life. It is living in intense awareness that the world is a vast community of living things, whose potentialities are not exhausted by our individual enjoyments, or even by those of the whole of mankind. The true conservationist regards science and technology as at best a useful instrument, which like any tool may be worthless, or even dangerous, except in the hands of one who knows how to apply it to worthy ends. And these ends are determined by the character and aims of the user. The correct application of our understanding of natural processes, of our ability to influence



". . .the true conservationist is generous. He wishes others to enjoy the blessings that Nature provides. . .all those treasures of beauty and knowledge which the natural world offers to those capable of appreciating them."

them, depends upon our qualities of mind and heart. What, then, are the attributes of the true conservationist, which make him the safe repository of power to control events in the natural world? We can distinguish at least nine such attributes.

Gratitude — The true conservationist is grateful to the natural world as the foundation of life, health, prosperity, and of all that makes life pleasant to him. He is thankful not only for the means of bodily existence, but for endless beauty, inexhaustible occupation for the intellect, and a setting wherein he can find tranquillity of spirit.

Love — Out of gratitude grows love. The true conservationist loves the natural world for its endless bountifulness to himself and those dear to him. But mere usefulness to ourselves is not an adequate ground for love. A tool or a piece of machinery, as an automobile, may be useful to us, but we do not truly love it, because all the qualities for which we value it can be exhausted through its service to us, then we throw it away. That is truly lovable which, however much it may serve or gratify us, can not thereby exhaust those qualities which endear it to us; as a mother, however much affection she may bestow upon a child, does not thereby destroy her capacity for devotion. Love is bestowed upon an object which serves or delights us, yet transcends our grasp. This is preeminently a characteristic of the natural world. The true conservationist loves not only Nature as an aggregate, but each living thing individually, because of its essential likeness to himself.

Compassion — From love springs compassion. The true conservationist is compassionate to all living beings, refraining from wantonly injuring them, and helping them to live by preserving conditions favorable to them.

Generosity — Because he is aware that he is only one living being among countless others, because he loves other beings and feels compassion for them, the true conservationist is generous. He wishes others to enjoy the blessings that Nature provides, not only the material means of subsistence, but all those other treasures of beauty and knowledge which the natural world offers to those capable of appreciating them. He wishes to share these goods not only with all beings now living, but with all future generations.

Frugality — In a world such as ours, a truly generous man will be frugal, because he is fully aware that under no possible economy can Nature provide enough of the means of subsistence to satisfy the needs of all those

creatures that are born into it. He will not waste food, nor consume carelessly any of the products of the earth, for when he does this some other creature goes hungry. Remembering that all that he eats, all except plain water that he drinks, practically everything he wears, and indeed every organic product that he procures, represents so much of the limited productive capacity of the earth diverted from other claimants to himself, he will use no more of them than is necessary to maintain health. This economy extends only to material things and need not touch the life of the mind or spirit, for it is the peculiarity of spiritual goods that they are never exhausted by use. Whereas the food I eat can nourish only myself, I do not by enjoying the beauty of a natural object diminish its capacity for yielding like enjoyment to countless others.

Foresight — In his dealings with the natural world, the true conservationist is foresighted. He looks not merely to the immediate results of his activities, but how they will affect his own welfare in future years, and that of generations yet unborn.

"The true conservationist realizes that Nature is too vast and manifold ever to be completely understood by him. . ."

Fortitude — The true conservationist is courageous. Because the maxims that guide his conduct are derived from sound understanding of natural processes and basic ethical principles, he will not be driven from his course by the threats or the ridicule of the ignorant, the selfish, and the greedy.

Humility — The true conservationist realizes that Nature is too vast and manifold ever to be completely understood by him, and makes no absurd claim to exhaustive knowledge of natural processes. Accordingly he hesitates to meddle with them, for the outcome of his shortsighted interference may be far other than he expects. On another side, his humility is such that he makes no arrogant claims of the absolute superiority of his own kind over all other kinds of life. He does not in blind boastfulness assert that mankind is the one end of creation, or the single branch of the animal kingdom through which evolution can continue indefinitely toward a glorious future. His humility leads him to suspect that the universe enfolds numberless potentialities of which he is ignorant, and that there may be whole realms of value of which he is unaware.

Reverence — The natural world is the visible expression of a creative force that far surpasses our understanding. Although it contains much of the pain, discord and frustration which we call evil, it holds also a vast amount of the joy, love, beauty and harmony that we intuitively recognize as good. This good seems to be the manifestation of a beneficent Power, which we can not contemplate without a feeling of reverence. From the Source, this sentiment is reflected back upon all its creatures, which the true conservationist regards with reverence. He has "reverence for life."

Finally, it may be noted that the attributes we have ascribed to the true conservationist are in general moral and religious virtues, or that these several attributes

closely approximate them. Gratitude is by nearly all men considered an essential component of a noble character, while ingratitude is looked upon as base and mean. Christianity emphasizes love, Buddhism compassion, while generosity is another word for the charity, which every great modern religion enjoins. Frugality is almost synonymous with temperance, a cardinal virtue in every important system of religion or ethics, including even that of Epicurus. It suggests that freedom from sensual excesses, that moderation in eating, drinking and dressing, which is the indispensable accompaniment of an exalted spiritual life. Foresight is an extension of prudence, which has been defined as that equal regard for all parts of our expected existence which prevents the sacrifice of the future to immediate advantages. But it goes beyond prudence in suggesting regard for a future that stretches far beyond one's own earthly span, and in safeguarding the rights of this future with scientific knowledge no less than moral restraint. Humility and reverence are primary religious attributes; to be haughty and irreverent is incompatible with piety.

It is because of this close correspondence between the qualities that make a true conservationist and the virtues inculcated by religion, that religion has through the ages exerted a powerful and on the whole beneficent influence upon man's treatment of the natural world — a fact which we are apt to forget. The earlier primitive religions were everywhere largely concerned with preserving the natural foundations of tribal prosperity, hence deprecated wanton destruction of animal and vegetable life. Not only did they predict dire supernatural retribution for the wanton slaughter of creatures used as food, in some instances they prescribed severe penalties to be inflicted upon those who needlessly destroyed trees or animals. Oriental religions, by insisting upon the sanctity of all life, have played a part in the conservation of Nature which we in the West can scarcely conceive. Our Western religions have not been so favorable to the cause of conservation, yet if we lived in stricter accordance with the principles of their greatest prophets, all of us would be better conservationists, and better practitioners of our religious beliefs.

Neither these attributes of a true conservationist alone, nor knowledge of Nature alone, will make us good and effective conservationists. But when we unite the correct mental attitude with true understanding of natural processes, we become conservationists in the best sense of the word.

Spring Industry

By GRACE STILLMAN MINCK

Ma Nature works on her large hooked rug;
Draws golden dandelions through green grass;
Threads a scarlet vine to tug
Gay color through the pattern. Pass
Over this carpet if you will,
Ma Nature goes on working still:
Weaving every spring again
On her glorious rug for the hearts of men.

Earth-Slit in the Calicos

By NELL MURBARGER

In the scenic desert portion of San Bernardino County, California, only three miles north of the little town of Yermo, on paved highways US 91-466, is situated a spectacular slit in the earth known as Doran Canyon.

Rising sheerly to heights of 200 feet and more, the walls of this strange gorge are made to appear even higher by reason of standing so closely parallel that their interval, in many places, may be half-spanned by a man's outstretched arms! Traversing the bottom of the gorge, throughout its mile length, is an auto road so narrow that all traffic is necessarily routed to flow in a single direction. Even then, the road occasionally veers so sharply that motorists must do some fancy maneuvering to avoid scraping fenders against the cliff walls in the more tortuous twistings of the gorge.

The gaudily colored Calico Mountains, in which this strange canyon is located, are heavily mineralized and have been mined extensively over a period of many years. Most important of their various yields have been silver and borax.

The female house finch sat close while incubating the eggs, which took eleven days. The gleam of the electronic flash when a picture was taken did not seem to alarm her.

Home Life of the House Finches

By PATRICIA BAILEY

Photographs by the Author

COLORFUL male house finches with their flaming red breasts, and their demure gray-striped mates are common all through the southwestern part of the United States. They range throughout the desert region, and nested in cholla and other wiry growth before the coming of white men. Today they find parks and wooded areas of cities to their liking. The cheerful song of the bright-colored males are reminders of springtime in Denver. Often late storms will bring a mantle of white over the city, but these birds will be bravely in full song.

Nesting starts in mid-April, and we have been accustomed to tie wads of cotton in the cut-leaf birch just a short distance from the window, and watch the antics of the finches as they work at the easy source of nesting material. All the finches of the neighborhood make repeated visits, a female resting upon the swinging cotton and pulling great tufts, while the male perches nearby. When a sufficient load has been gathered, the little brown bird flies to its chosen nesting spot in our garden, usually in a blue spruce, but often in a juniper, and attends to her home building, while the ever-helpful male follows closely — and again sits by while his mate does all the work. There must have been a dozen pairs gathering cotton during the last two weeks of April, and all had their nests in our garden, or nearby.

The second nesting of the house finches started in mid-May, and on the twenty-second I noticed a female busily tugging away at the ball of cotton, which had considerably decreased in size, due to its popularity during the preceding months. Her mate was not so brightly colored as most males, and he gave the same assistance as the others — none at all. In addition to the attending mate, however, was a young bird still showing traces of down on the head. The youngster eagerly begged for food from the mother so busily engaged in securing construction material for a new home. It was evident that the house finches lost little time in starting a second nesting.

As I watched, the female flew directly to a spruce

fifty feet from our kitchen window, closely followed by the male and the fledged youngster, and disappeared in cover some twelve feet from the ground. She stayed for several minutes before returning for more cotton. The nest was fully finished by May 24, and there was one egg in it the following day. On May 28 the set of four was completed and incubation had started.

We decided to make a few life history pictures of our friendly little neighbor, so erected a makeshift blind on the top of a ladder, a bit of canvas that would effectively conceal the photographer and equipment. During the following few days we enjoyed prying into the household affairs of the happy couple.

The female sat close, but when disturbed usually joined her mate on a wire, or in a nearby tree, where they would go through a little ceremonial of wing preening, and often the male would give her food. She would soon return to her nest, however, and the gleam of the electronic flash as we shot pictures was so rapid that she was not alarmed.

The eggs started hatching on June 7, after an incubation period of eleven days, and the following morning all four of the feeble babies were free of their shells, with the mother brooding them constantly, except for short forage periods. The wobbly little heads showed above the rim of the nest, and the female perched on the edge of the nest had to nudge the babies to make them open their mouths for nourishment.

They were not too hungry at four days of age, but eagerly gulped food whenever either

The male house finch above seems to be gazing with pride at the nest full of four-day-old youngsters. They were not too hungry at four days, but gulped food whenever it was brought to them.

The mother finch, at the rear, and the young at fourteen days. By this time the youngsters were fully clad in feathers that resembled the mother bird. The largest of the offspring stood on the rim of the nest eagerly awaiting food.

Hungry mouths of the six-day-old finches greeted the mother, who was kept busy feeding her brood.

parent returned to the nest — the mother still hovering the small fellows when not food gathering. When six days old, however, they raised their knobby, fuzz-covered heads on skinny necks, with wide extended beaks, whenever a parent landed upon the nest. Both the old birds were feeding; the female came in about every half hour, while the male would usually space his visits about two hours apart. Faint traces of pinfeathers were beginning to show on shoulder patches of the young at this age.

One time, while I was clinging to the ladder awaiting the return of an adult, a robin nearby was disturbing the whole neighborhood with his constant alarm note. Peeking through a slit in the canvas, I could see the old redbreast teetering on a wire, while flanking him on either side were nine chirping house finches, all much interested in the cover underneath. Soon there was a movement, and a tawny house cat slid stealthily along. Peace did not reign in the neighborhood for a full half hour.

During the first ten days the female spent most of her time with the young, brooding them at first, and perching on the back rim of the nest after the first week. We kept the nest under observation every day, and noted a gradual change, the pinfeathers expanding until, on the fourteenth day, the young were fully clad with feathers resembling the female. They had short, stubby tails, and tufts of down on heads and shoulders, and one — possibly the first hatched — was much more active than the others. All the young and both of the adults were now very camera conscious, and the slightest movement from behind the blind would cause an old one to fly, and the three less aggressive young to crouch in the nest. The larger one perched on the rim in the coolest place possible and kept a roving eye for the return of his food supply. After a few high-speed pictures had been obtained, both of the old ones would alight on a limb back of the nest and feed the young without coming completely into view — and finally coaxed the large young to a nearby perch entirely out of camera range.

We did not take additional pictures, for we wanted the young to remain in the nest the normal length of time. On the evening of the sixteenth day only two young remained, probably the last two hatched, and the following morning all were gone. Anxious chirping in the blue spruce nearby indicated that the concerned parents had their children under observation, however, and we knew that all was well. We had enjoyed an interesting month with our avian guests, and had learned something of their life history — that nest building and egg laying takes about seven days, that downy babies should appear in eleven days more, and the young should remain for approximately sixteen days, a time elapse of thirty-four days from the start of the nest until the young were safely launched awing.

Pequot-sepos, A Unique Community Program

By A. W. WRIGHT

PHOTOGRAPH BY FRANK JO RAYMOND

A converted barn is now the Trailside Museum of the Sanctuary, the main trail entering the area leaving the road here.

JUST outside Mystic, Connecticut, on the headwaters of the Pequot-sepos, "The Little River of the Pequots," is an outstanding educational experiment. In the closing days of World War II, the Pequot-sepos Wildlife Sanctuary was an idea. Today it is a monument alike to extraordinary community vision and spirit, and to the enterprise and professional ability of one man, Thomas P. McElroy, Jr., the curator.

Wildlife sanctuaries are not in themselves unique. Audubon societies, and other groups and individuals, the various States, and the Federal Government, all maintain sanctuaries. However, this 125-acre area just off the Sound in southeastern Connecticut may be the only wildlife refuge in the United States — large enough to maintain a full time resident curator and a natural history museum in addition to the refuge itself — which has been conceived and developed by a community, and is entirely supported by voluntary local subscriptions. In this program there is a message, a hope, and a model for the future for everyone interested in conserving portions of our forest heritage. And there is a particular message for those who would like to do this as much as possible in our traditional way, by community cooperation.

Tom McElroy is curator of the Pequot-sepos Sanctuary. Sometimes he has to do desk work, also.

PHOTOGRAPH BY FRANK JO RAYMOND

The Pequot-sepos valley was once the demesne of Captain George Denison, who settled there in 1654. The present manor house, built on a knoll at the head of the valley in 1717 by the third George, is preserved by the Denison Society as an historical monument open to the public. Also under the control of the Trustees of the Denison family society is all that community growth has left of the original great estate. This land is located at the head of the valley. It is probably as varied as any land in Connecticut could possibly be. There are precipitous, ledgy ridges; typical, stony slopes; rich, wooded flats; bogs, stream, ponds and meadows. For the most part it is in woodland; woodland showing all the effects of two hundred years of the sort of periodic butchering that all southern New England forests have undergone.

When the idea of a community wildlife refuge originated in Mystic in 1945, the Denison Trustees were approached and asked whether they would consider the use of this land for the purpose. They agreed, subject to various conditions concerning the formation of a financially responsible, non-profit corporation to which the land could be leased. The drive was on!

The land was surveyed by experts as to suitability and was pronounced excellent. An organization committee was formed. A membership drive by volunteer solicitors got up steam. And, most important, the decision was made that no wildlife refuge would ever amount to anything as a center of community life without a resident curator. Provision for his

salary and living quarters was the primary requisite after suitable land had been secured.

Here the Denison Society stepped forward. They offered a wing of the old manor house, on condition that the prospective curator be married and that his wife be willing to act as Museum Hostess. And, in addition, they turned over the barn on the property to be converted into a headquarters, trailside museum and workshop. By this time the movement had become virtually a crusade. The fervor was so contagious that summer visitors in Mystic and nearby towns also subscribed as members. The drive was in high gear and really rolling. But still the most important problem of all had not been solved. Who was to be in charge? Everyone realized that the ability of the first curator was vital to any permanent success.

Numerous candidates were interviewed, and finally a choice was made. Tom McElroy, an Air Force veteran, had been a Boy Scout executive in Pennsylvania. He was chosen because his combined background as naturalist, ecologist and teacher equipped him so thoroughly for the job to be done. But it has been Tom McElroy's drive, even more than his training, which has made, and is making, the Pequot-sepos Sanctuary what it is.

The main trail of the sanctuary leads into the primary tract between the museum and the parking lot across the road from the old Denison Homestead. As the visitor enters the sanctuary proper he passes a developed picnic area complete with rustic benches and tables. While there is no force employed to prevent visitors from throwing lunch wrappings around in the woods, the psychological effect of picnic tables, which are so conveniently nearby, gently achieves the same result.

Past the old stone wall the woods and the trails begin. Every visitor is provided free of charge with a large copy of a trail map. For that matter, aside from purchases at the well-stocked Trading Post in the Museum, no charges are ever made to anyone for any of the services at Pequot-sepos. All lectures, field trips and literature are free.

Whether one wanders alone, or accompanies one of the Nature walks specializing in bird watching, geology, botany, astronomy, forestry or ecology, one is immediately struck by the fact that a large part of the area is one vast series of highly organized, self-explanatory demonstrations. And yet, Tom McElroy seems sincerely to think that he has hardly gotten started! As he puts it: "The good done here is important on these acres and in this area, but it's the teaching aspect of the demonstrations that really counts. What we are trying to do is to *show* people so that, firstly, they will understand what it's all about, and secondly, perhaps, go somewhere else and do something about it."

An excellent example of Tom's methods is the Woodlot Management Area. It is reached by following the Blue Trail arrows and metal flashes on the trees.

PHOTOGRAPH BY THE AUTHOR

Numbered signs in the forestry demonstration area refer to various details of good and bad treatment of a forest area.

Before you quite realize that you have arrived you come to a housed-in box on a tree beside the trail. On it appears a neatly lettered sign inviting, "Take one." You do so, of course, and find yourself reading a small leaflet providing a sketch map of the demonstration tract, an explanation of its purpose, and a brief survey of what constitutes sound forestry practice in this type of woodlot. Then there is a list of thirty-three numbers.

Suddenly you notice ahead of you little, white, numbered signs stuck into the ground beside the stumps and stubs of a fairly recent cutting operation. You look back to the leaflet in your hand and see that after every number there is the name of a tree and a brief explanation, in terms of practical forestry, of why it was cut. For no particular reason you notice "No. 28: WHITE OAK — Its removal frees straight 7-inch hickory and two small, more promising white oaks." You look, and there, sure enough, are the hickory and the two small white oaks.

As you look around you, comparing the leaflet explanations with the actual situation on the ground, particularly if you are a trained forester and can recognize the skill with which the stand was marked, you wonder why this sort of thing is not done more frequently. As the leaflet rather modestly puts it: "It is thought that if improvement of the stand through the application of forestry principles could be shown on a small tract of typical forest, the same principles could be applied to his own woods by any woodlot owner

after he had carefully studied the demonstration area with this explanatory leaflet." And well he might!

Map in hand you leave the Woodlot Management Area and wander around the trails. The wildlife is literally omnipresent. As always, after sanctuaries have been established for any length of time, the wild things seem to realize by some sixth sense that here man is not the dangerous predator that he is elsewhere. The birds particularly impress you by their variety and abundance.

Time after time you pass wildlife food plantings of exotics, or of obviously introduced native species. If you happen to be on the Yellow Trail, which loops around the central ponds, these plantings may have little explanatory signs beside them.

As a matter of fact, on this Yellow, or Nature Trail, as it is also called, from spring to fall nearly everything of interest has its explanatory sign, and seldom indeed does the sign confine itself simply to naming the object. Many signs echo the chief emphasis in all of Tom McElroy's lectures — ecology, the interplay of the relationships of Nature. He regards this as the true science of the naturalist, and is working on a book about it.

Here there is a living demonstration showing plant succession. There is one illustrating the role of understory shrubs. Farther along are areas ideally adapted to illustrating the principles of Connecticut geology and its effect on the vegetation. What digs the burrow the fox lives in? What is the life cycle in a forest pool? What is that peculiar shrub, and what is it good for, if anything? Tom McElroy's signs, or he himself, will show or tell you.

PHOTOGRAPH BY THE AUTHOR

There are areas of dry, ridge-top former pasture that are reverting to forest. Such places illustrate the processes of succession and supply food and shelter to many species of wildlife.

Nor are these demonstrations confined to the living and to the outdoors. There is also the Trailside Museum. Here bird identification boards flash lights when two wands touch the right picture and the right name. Here are collections of nests, and shells, and minerals. Here are varied set pieces in the old New England surroundings of a remodeled barn. And here is the Trading Post, selling woodland products, the only place on the whole Sanctuary where it is possible to spend any money.

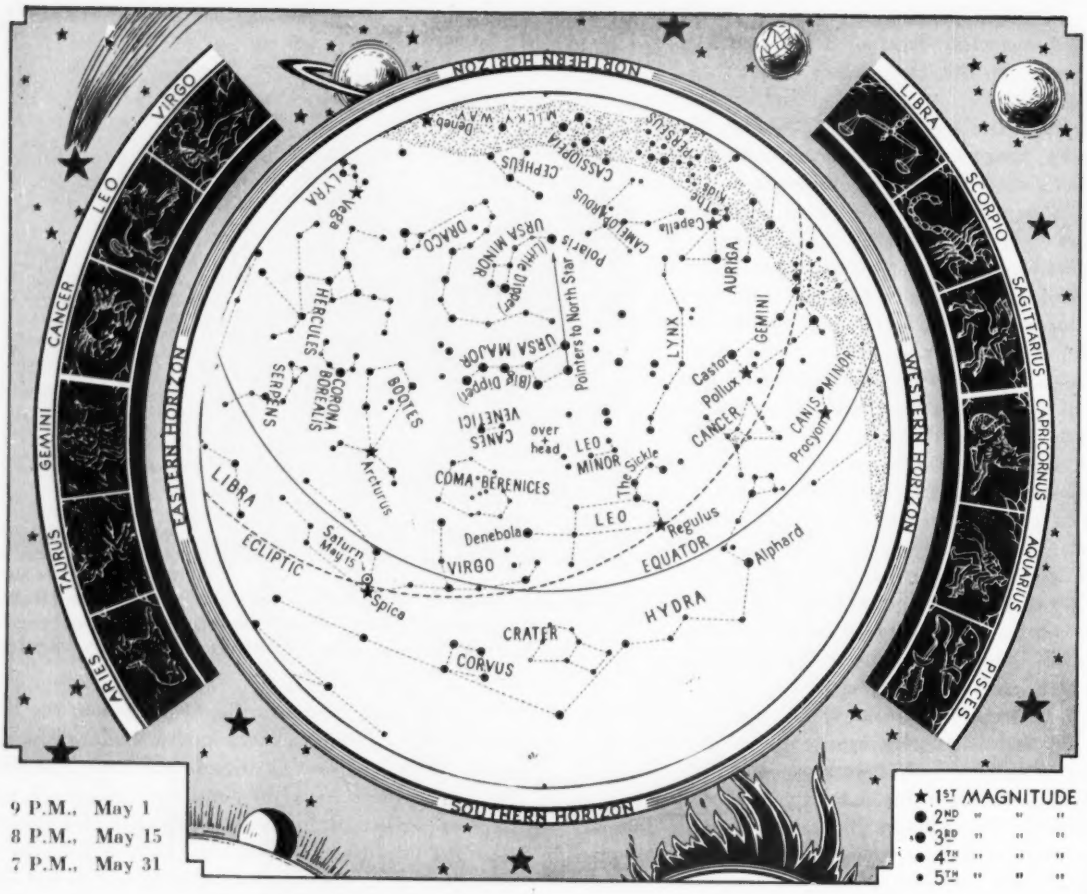
It is here in the Museum that the many illustrated lectures, motion pictures and open forums are held. And from the Museum set forth the extended Sunday afternoon naturalist hikes, not only through the Sanctuary, but to points of neighboring interest, such as the quarries on Lantern Hill, unspoiled areas on the seashore, and Assekonk Swamp. All this, remember, is not an educational experiment sponsored by the Federal Government, by a State, or by a wealthy and influential society. It is a community project supported completely by local, voluntary subscriptions and by a few interested individuals in other States.

After a few hours of exploring the Sanctuary, investigating the fascinations of the Museum, and talking to the curator, the inescapable impression is that Tom McElroy must either be triplets or else jet propelled; this despite his appearance of being a normal, thirtyish, highly educated, slow-moving backwoods type with the forest in his blood. How deceiving can appearances be?

In addition to having built up the Sanctuary and the Museum to (Continued on page 276)

In one of the swampier and less accessible parts of the sanctuary is this wildlife food area.

PHOTOGRAPH BY THE AUTHOR



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

In the Zodiac

By ISABEL M. LEWIS

OF SPECIAL interest and importance in the heavens is the broad belt, or zone, known as the Zodiac. This extends about eight degrees to either side of the ecliptic, or apparent yearly path of the sun.

The width of the Zodiac is such as to include within these limits the sun, moon, and all of the planets, wherever they may be in their orbits. All of the planets except Mercury and Pluto have orbits inclined at very small angles to the ecliptic, and keep well within these limits. Pluto, the most distant planet, has an orbit inclined at a very high angle to the ecliptic, and in certain parts of its orbit is far outside the bounds of the Zodiac, but this small, faint planet is not one that is visible without the aid of a telescope. Uranus and Neptune also were discovered centuries after the Zodiac was defined, and are not objects to be seen and observed with interest in our night skies without a telescope. They do, however, have orbits that lie close to the plane of the ecliptic, and are well inside the limits of the Zodiac.

One should become well acquainted with the constellations of the Zodiac to derive pleasure from observing the ways of the planets as they are seen against the background of the stars, apparently wandering — as their name implies — somewhat aimlessly among them at times. It is only among the zodiacal constellations that one need look for sun, moon and planets.

The diurnal course of the sun across the sky, from its continuously changing points of sunrise to those of sunset, defines the position of the central line of the Zodiac as seen in the observer's latitude from day to day, and season to season, during the year. It will be interesting to note the great change in the position of the Zodiac during the year by observing the sun's

position by day and the moon and planets by night.

The path of the full moon across the night sky from moonrise to moonset is the same as that of the sun approximately six months earlier or later. This is so because the sun and the full moon are always in diametrically opposite positions in the heavens. The course traced out by the full moon across the night sky in June, for example, will be close to that traced out by the sun by day in December, and vice versa. It is for this reason that the full moon in winter "rides high," rising in the northeast and setting in the northwest, and crossing the meridian high above the southern horizon. The maximum hours of *moonlight* are in the winter months. In summer the full moon "rides low," for it then traces across the night sky the approximate path of the sun in the winter months. It rises in summer in the southeast, crosses the meridian at its lowest elevation above the southern horizon, and sets in the southwest. So the fewest hours of *moonlight* are in the summer months. This is in agreement with the well-known fact that the fewest hours of *sunlight* occur in winter, and the maximum hours of *sunlight* in summer.

The word Zodiac is derived from a Greek word meaning "living beings." With one exception — Libra, The Scales — all of the constellations in the Zodiac bear the names of living beings. The twelve constellations of the Zodiac bear the same names as the Signs of the Zodiac. The latter were devised centuries ago for the benefit of the astrologers of that time, rather than the astronomers, and they are astronomically of little, if any, use today. The vernal equinox, or point of intersection of the celestial equator with the ecliptic, is the initial point in fixing the positions of the Signs of the Zodiac. Twelve divisions, each thirty degrees in length, were made along the ecliptic, counted *eastward* from the position of the vernal equinox. Their width was that of the Zodiac itself. These were the Signs of the Zodiac, and about 2000 years ago each one fell within the constellation of the same name. Each Sign was divided into 30 Points, a degree long. The first Sign, counted eastward from the vernal equinox, was that of Aries, The Ram. The vernal equinox was known also as the First Point of Aries, or also as "The First of Aries," and when the sun was at the vernal equinox at the beginning of spring in the northern hemisphere it was said to "enter the Sign of Aries," or to be at the "First Point of Aries." Following in order after Aries, in the eastward direction along the Zodiac, come the Signs of Taurus, The Bull; Gemini, The Twins; Cancer, The Crab; Leo, The Lion; Virgo, The Virgin; Libra, The Scales; Scorpio, The Scorpion; Sagittarius, The Archer; Capricornus, The Goat; Aquarius, The Waterbearer; Pisces, The Fishes.

May Flowers—Double Feature

By RAY ROMINE

These fragile faces peering up at me,
Pale in the dusk, and so sincerely shy,
Are blooms of May that herald, quietly,
The gems to flower in the midnight sky.

The first three Signs of the Zodiac are called the Spring Signs, the next three are the Summer Signs, the following three Autumn Signs, and the last three Winter Signs. The sun is said to enter the Sign of Cancer and summer commence — in our hemisphere — when it is farthest north, at the time of the summer solstice. Autumn begins when the sun enters the Sign of Libra. It is then again on the celestial equator, 180 degrees from the vernal equinox, that is at the second point of intersection of the celestial equator and the ecliptic.

Winter, in the northern hemisphere, begins when the sun enters the Sign of Capricornus, at the time of the winter solstice, when the sun is farthest south of the equator. It will be seen that the Signs of the Zodiac are unalterable in position because they are counted eastward from the position of the vernal equinox, wherever it may be, a definite number of degrees. The vernal equinox itself, however, is not a fixed point in any one constellation. Although it is the point of intersection of the celestial equator with the ecliptic there is a gradual westward shift of the equator along the ecliptic and a conical revolution of the pole of the equator around the pole of the ecliptic in a circle of radius about 23½ degrees; so the poles of the earth are not fixed with respect to the constellations. A complete circuit of the poles of the earth around the poles of the ecliptic is made in about 26,000 years, and in the same period the points of intersection of the celestial equator with the ecliptic make a complete circuit of the heavens. The shift is from east to west, as if the equinoxes advanced to meet the sun, which is moving in the opposite direction, at its return each year — from which comes the term "Precession of the Equinoxes" for this motion. It follows, as a result of the "Precession of the Equinoxes," that, although the Signs of the Zodiac are fixed in position at all times, the constellations of the Zodiac are not fixed in position with respect to the vernal and autumnal equinoxes, or the summer and winter solstices.

About 2000 years ago, as we have said, the Signs of the Zodiac were in the constellations of the same name. Since that time the vernal equinox has moved westward along the ecliptic into the constellation of Pisces so that now at the beginning of spring in our hemisphere — autumn in the southern hemisphere — the sun is entering the Sign of Aries, as before, but it is in the *constellation* of Pisces. For the same reason at the beginning of summer the sun is still in the Sign of Cancer when farthest north, but in the *constellation* of Gemini. At the beginning of autumn it is in the Sign of Libra, but *constellation* of Virgo. Winter now begins with the sun farthest south in the Sign of Capricornus and the *constellation* of Sagittarius. About 2000 years from now the equinoxes will have (Continued on page 276)

The School Page

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

GAME BIRDS IN SCHOOL

THIS time I am afraid you have me in a corner. When I wrote an insert about dragon flies and mayflies, I told you that they could be seen in almost any school in the country. I told you the same about beetles, flies, birds and mammals. But when it comes to game birds, I am not so sure. Of course there are many schools that have never been visited by a pheasant, a wild turkey, a quail, or a ptarmigan. If this is the case you must turn to your books and other printed sources to see what help they suggest.

In the West and mid-West it is sometimes easy to encourage a covey of quail to live about the school grounds. Children can vary their Arbor Day activities, and, instead of planting another shade tree, can plant some shrubs and vines that will have food value to Bobwhite. Wild grapes, sumac and similar woody plants that retain their fruits through the winter are to be recommended for such planting.

In Iowa, under the leadership of Dr. George Hendrickson of Ames, many a rural boy got some of his best training in wildlife management by assisting in making surveys of the coveys of quail to be found in a neighborhood. Partly from the data thus collected, determinations were made regarding total populations, and practices were predicated on these findings.

The greatest value in having school children participate in surveys of this sort lies not in the data collected but in the interest aroused in youngsters to try to improve the conditions of the wildlife that may share their environment. Management includes management of cover, and observant children can well notice where they are likely to find wildlife most abundant. Conditions that encourage birds can be duplicated elsewhere with reasonable assurance of success. Management includes food management, and this, too, can be understood to some extent by observing what the birds of the neighborhood eat. To me, one of the best lessons I ever had on the value of these birds was the self-imposed practice I adopted of examining the crop contents of birds available for such examination. A bird whose crop is full of weed seeds must appear of value to a boy whose chores include a little weeding now and then. Of course, there are other values that are revealed by such study.

Many schools located near open country maintain some sort of bird feeding station. Usually this is the sort that attracts chickadees, nuthatches, woodpeckers, English sparrows and, possibly, rats. Why not try to establish a feeding station for game birds? Waste grain from the barn floor, or from a feed store, may be all the food needed. In winter, of course, if there are deep snows, this food should be given some protection. A shelter of corn shocks, hemlock boughs, or some similar farm material may be all that is needed to save a covey of quail when the going is really tough. Pheasants, too, are often saved in winter by feeding stations established by school children. Usually these stations take into consideration the hazard caused by deep snows. Because of this, the food may be placed high enough above the ground to prevent its being buried and yet low enough to be accessible to birds that live normally close to the earth. These heights can be determined by the youngsters themselves, and the determination solves a practical problem. Do not fail to provide water in dry areas or dry periods.

As an aside, let me again suggest that, if you have a feeding station, you make some effort to find if birds show any tendency to color blindness. Color a pint of grain blue, another pint red, another yellow and still another green, using Easter egg dyes. Spread these colored foods where they may be eaten by such game birds as the quail. Do they tend to leave any one of these colors uneaten in preference to the others? If the feeding station is visited by rats or mice, do they show the same tendency as did the birds? Knowing this, can you suggest any way in which it might be useful to destroy some of your visitors without harming the others?

The geography teachers may wish to use the second section in each of the life history tables to get some idea of the geographic distribution of our game birds. Properly used, this would introduce some children not only to all the major areas of North America but to other continents as well. Maps may be made, either for use in notebooks or for charts, with pictures of the birds pasted on the area from which they come. Possibly the most useful pictures of this type are the sets of colored stamps issued by the National Wildlife Federation of Washington, D. C. This year's set features the lesser prairie chicken, and other material on this bird may be procured by teachers who write to the Federation. The Audubon societies and state conservation departments have also, from time to time, provided useful material on the game birds considered this month.

Arithmetic teachers should find, in the tabular material of this month's insert, problems on size, weight, length of tail and wingspread that should be useful. For example, which American is the largest and which the smallest? Which of the eighteen birds considered lays the largest number of eggs for one clutch, and which is capable of laying the largest number for the year, providing there is more than one annual brood? Which of the birds probably have the greatest recuperative powers, can best withstand inroads on their numbers by enemies, and should respond most promptly to protective practices?

Any study of these birds in school should give some consideration to the birds' enemies. There is probably more vicious misinformation about the supposed killing of game birds by hawks than on most related subjects. Reports of this sort should be checked carefully, and, if a hawk has been found killed, it might be well to dissect out the stomach and find whether the food bore fur or feathers. This study, of course, can well be expanded to include some review of our studies of the preying birds. We handled this in the nineteenth of these inserts, entitled "Let's Pray for the Preying Birds."

Some schools may be interested in studying tracks. Some of these birds provide intriguing opportunities. The "snowshoes" worn by ruffed grouse in winter leave a different track than does the same bird in summer. Notice that in most of these birds that get their food by scratching, only three toes show in the track. The fourth toe is usually higher up, greatly reduced in size.

Few groups of birds can match the skill possessed by these birds in employing protective patterns and behavior as assistance in survival. A hen pheasant in a grassy field, or a ruffed grouse on its nest on the forest floor, might as well be in another county so far as concerns the average person. Then, too, there is the ptarmigan's remarkable change of plumage for summer and winter, making it practically invisible in the exposed situation in which it lives. Try to find a whole brood of ruffed grouse that may have hatched only an hour before.

It would be well to call attention of the students to the spectacular sex differences displayed by some of these birds. This is possibly best exemplified by the pheasants, and is least conspicuous in some of the quails, although it is next to impossible to tell a male ruffed grouse from a hen grouse at some times of the year.

Some recognition should be given to the fact that at least one species of these birds —the heath hen — has become extinct in the recent past. Others may well be approaching that fate. Let the children decide how they feel about this, and what, if anything, they would wish could be done to help, in the situation. Perhaps they can do more than you think. Please give them the chance.

New Products etc.

MBT was tested last summer by the mountaineers of the Yale Logan Expedition to the Yukon and proved "worth its weight in gold." This new instant beef tea has now been put on the market for outdoors people by Romanoff Caviar Company, 480 Lexington Avenue, New York 17, N. Y. . .Vio-Holda Mfg. Co., 512 Western Avenue, Topeka, Kansas, announces an all-steel plant stand with revolving arms. They also produce a 34-pound, eight-foot, aluminum boat. . . . During the past Christmas season Abbeon Supply Co., 179 Jamaica Ave., Jamaica, N. Y., found paper weights adorned with a miniature dinosaur, *Tyrannosaurus rex*, very popular. Now they have brought out a desk pen set with this prehistoric reptile standing guard over the pen. And you have a selection of eight other contemporaries of this fellow, if preferred. . .Bell and Howell, 7100 McCormick Road, Chicago 45, Illinois, announces a new three-inch f/3.5 telephoto lens for 16mm motion picture cameras. . .Nutritional Concentrates, Inc., 3090 West Liberty Avenue, Pittsburgh 16, Pa., announces" Fertileze", said to be a new plant food providing both major element and trace mineral nutrition. Can be applied to lawns and gardens in the process of sprinkling. Worked out at Louis Bromfield's Malabar Farm and elsewhere. . .M. P. White Co., 55 Stuart St., Boston 16, Mass., has "4-1 Camper," a knife, fork, spoon and bottle opener, all in stainless steel and packable into a compact vinyl carry-case. Costs $1.50. . . Agri-Plast Products Co., P. O. Box 142, 648 South Orange Avenue, Sarasota, Florida, announces "Airwrap," a method of seedless germination of new plants, either by air-layering, or by propagating roots on plant cuttings.

Ant Nest

Every once in a while we receive a request for information as to where an observation nest for ants can be purchased. Two earlier sources of supply seem to have vanished, but we are happy to note that the W. M. Welch Scientific Co., 1515 Sedgwick Street, Chicago 10, Illinois, offers a "Vertical Type Observation Ant Nest, which is also adaptable for use with other soil-inhabiting animals. Infra-red glass plates attach to each side of the nest to simulate darkness within. Apparently the nest does not come supplied with ants, but this should be easily remedied in any locality.

Bergen Swamp

During the past year 69.34 acres in six parcels were added to Bergen Swamp, near Rochester, New York, according to the annual report of the Bergen Swamp Preservation Society. This brings the total acreage thus far acquired to protect this outstanding area to 606.05 acres.

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Camera Trails

By
EDNA HOFFMAN EVANS

GENERALLY speaking, I prefer the picture-taking side of photography to the picture-printing side by a ratio of about eighty to twenty — or seventy to thirty, at the very most. However, when I do get started on work in the darkroom I often become so fascinated that I find it hard to stop. I always want to print just one more picture.

In addition to straight developing, enlarging, and printing, there are some other tricks one can perform in the darkroom that are novel and interesting. Bas-relief photography is an activity of this nature.

Bas-relief, incidentally, is one of those words that is not pronounced the way it is spelled. The "s" is silent and the "a" takes on an "ah" sound. As a result, bas-relief is pronounced as though it were spelled "bah-relief." The word is derived from the Italian art term *basso-relievo*, which denotes sculpture carved in very low relief, in contrast to *alto-rilievo*, or sculpture that projects from its background by half or more than half of its natural circumference.

Of course, in photography the picture does not protrude from the background at all — it just appears to. The relief effect is an optical illusion. The finished product looks complicated, but actually it is not difficult. The process of producing it is tedious, but nothing more.

To make a bas-relief picture you begin with your negative. This should be selected with care, for not all subjects are suited to this technique. The picture should be simple and the masses should be heavy and sharply defined. Straight lines and scenes with perspective are suitable, while subjects that contain many details and a wide scale of tonal values are seldom satisfactory. The negatives themselves should have sharp, clean-cut outlines and good contrasts.

From the original negative you make a second "positive" transparency, printed on regular film. This is done with a contact printing outfit and the second transparency should be the same density as the original negative. It is developed the same as any other piece of exposed film.

When you are ready to print, place the negative and the positive together so that the images rest one above the other. Hold them up to the light and you will see that the dark areas of the negative completely cover the light areas of the positive. Move them slightly and you get the effect of a shadowed edge that makes the subject stand out in seeming relief.

For best printing, the two films should be emulsion side to emulsion side. Just how much overlap you allow depends on your own judgment. The more overlap, the greater the shadows; the more shadows, the greater the seeming depth of relief. However, this can be carried to extremes. Too wide an overlap finally destroys the illusion of depth and results in nothing more than a blur.

The unalike twin towers of old San Xavier mission provide good bas-relief photography material. Straight lines, simplicity, and perspective are important basic elements.

The films should be taped together to prevent movement after the offset has been determined. It is best to move the offset on the diagonal rather than on the vertical or horizontal. Best printing results are obtained on a hard or medium hard paper. A more uniform result is obtained when the two films are of the same density, but, once the technique is mastered, striking results may be obtained with films of different density. In fact, there are a number of possibilities the photographer can try if he really wishes to experiment.

This is a print from a positive transparency. In it the normally light areas appear dark and the normally dark areas light. The effect is eerie and unexpected.

Just what does one do with a bas-relief photograph once he has made it? That is a good question. Certainly, one would not want too many of them around. However, they make interesting novelties; sometimes they appear in salons, and they are also used for greeting cards, as book plates, and for illustrations of a similar nature.

Now, having discussed the theoretical how-to-do-it side of bas-reliefs, let us see what actually happens when we try to print some.

When I started the present project, I chose three negatives from the files. Each one, I thought, had good possibilities as bas-relief material. One was the picture of a large white night-blooming cereus flower. The second was the shot of a sail boat. The third was a picture of the unalike twin towers of old San Xavier del Bac mission near Tucson, Arizona.

I began with the mission negative. First I used the contact printer and made a positive film, giving it a "one-two-three" count. Thirty minutes later, after it had gone through developer and hypo, I looked at it and decided that it was not the right density. I tried again, this time with a "one-two" count. That result did not look right, either. I tried a third time, once with a single count and once with a "one-two-three-four-five" count. When developed, the last one looked best of all.

With the timing determined on the basis of one negative, I proceeded to make positives from my other two choices, the flower and the sailboat. The flower

negative was extremely thin, so I gave it a "three" count. The sailboat was thick so I gave it a "ten" count. Results: The flower was almost too dense to see through; the sailboat looked about right.

Now it was time to print. Again I began with the positive and negative of San Xavier. Putting them together was quite a job. Neither film was particularly thick but when they were held together, even against a light, it was difficult to see through them. It was more difficult still to get them adjusted just enough but not too much off center. In the enlarger there was more difficulty — so thick were the two that very little light came through them to the paper below. Accurate focusing was difficult. The first print was disappointing — there was too much "bas" in the relief. The second print had too little "bas." Finally, after a third adjustment, I got a satisfactory print — burning it in for a full three minutes under the enlarger.

The flower combination was hopeless because the positive was much too dense; no use bothering with it. I laid it aside for another time.

The combined positive and negative of the sailboat also proved to be too dark. I could not see through them, even against a bright light. There was no way of adjusting the overlap, and, even so, I knew that light from the enlarger could not penetrate through the double thickness of dense film.

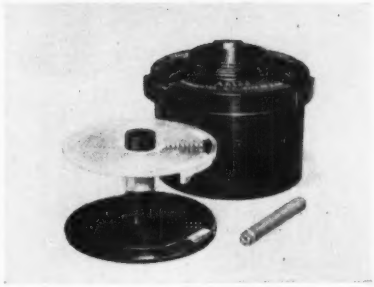
The positive looked interesting, however. I decided to experiment with it. Accordingly, I printed it just as though it had been a regular negative. The result was a phantom ship, a dim gray wraith, manned by ghosts, sailing on a murky ocean against a leaden sky. I rather liked it; it made me think of the *Flying Dutchman* or the ghastly vessel in "The Rime of the Ancient Mariner." I think that positive printing is worth experimenting with further.

And now, at any rate, Dear Reader, you have both the theoretical side and the actual trial-and-error procedure of bas-relief photography. There is a fascination to it; it is fun to play with. But — a word of warning — do not embark on a bas-relief photography project unless you are willing to devote several afternoons or evenings (probably both) to the undertaking.

NEW ITEMS

Ansco has on the market a neat new film-developing tank with a patented film reel that literally loads itself. Winding film for tank development is not a particularly easy task, as anyone who has ever tried it knows well. The film has a tendency to buckle and jam in most loading reels. The Ansco device, however, does more to eliminate these irritations than any other reel on the market.

The reel is adjustable for all regular film sizes from 35mm to 116. Once loaded, the reel fits into a plastic tank.



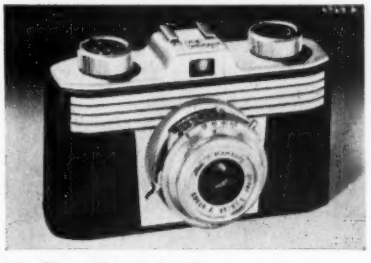
This is the new, easy loading film reel and developing tank now being marketed by Ansco.

The tank itself has a locking top with a built-in funnel and easy pouring drainage outlets. Twenty-four ounces of developer is ample to cover size 620 film.

This new Ansco tank and reel, complete with agitator spindle and practice film strip, sells for $4.95 at all photo supply shops that carry Ansco products.

The new Kodak B-C flashholder.

Eastman is now marketing a new Kodak B-C flashholder that combines the advantages of several previous devices of a similar nature. The reflector can be used on either side of the camera, while the holder has an extension unit connector post that will permit twin flash synchronization, if desired. The outfit, which includes both the Kodak B-C flashholder and the Kodak 2-way flashguard, is listed at $10.40.



The Iloca Quick "A" is a new German-made low priced camera.

As for new cameras, the Ercona Camera Corporation, 527 Fifth Avenue, New York 17, N.Y., is acting as distributor for a new low-priced German-made camera, the Iloca Quick "A." This is a 35mm camera, equipped with a hard-coated, color-corrected f:3.5 Ilitar lens and a Gauthier "Vero" shutter with speeds from 1/25th to 1/200th, and bulb. The price, including federal tax, is $39.95.

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SCHOOLBOY EXPLORERS

(Continued from page 244)

departments and other interested bodies. The boys are encouraged to develop their own special interests, from botany to bird-watching. Teams are formed to take part in surveying, meteorology, and geology.

Camp equipment and cooking utensils are provided by the Society. No guides or porters are employed, the boys learning to look after themselves, set up camp and prepare and cook their own food.

Diet is scientifically planned, with a few extra luxuries provided at the base camp. In addition to equipment, each boy carries his own marching rations. These include pemmican (a mixture of fat and powdered beef) cookies, cheese, margarine and sugar, some dried vegetables, chocolate, oatmeal and tea. In prewar years, when the expedition visited Lapland and Newfoundland, prepared reindeer meat was taken. Rations are supplemented with fish caught by the explorers.

Medical and surgical stores are taken, and the health of the boys carefully watched. Portable radio sets furnish a connecting link with base camp, and, when in Commonwealth territories, with amateur radio enthusiasts in the region; direct contact is also maintained with the Admiralty in London.

These expeditions are not only interesting and exciting vacations for schoolboys; they are training hardy and experienced pioneers who will be the explorers of tomorrow.

Mandarins

The Mandarin Duck. By Christopher Savage. New York. 1953. The Macmillan Company. Foreword by Peter Scott. 78 pages. Illustrated. $5.00.

One of the most beautiful and outstanding of the ducks is the Mandarin, now naturalized in parts of Great Britain. In this book the author delves first into this duck in literature and art, then considers the bird in its native East, and, finally, its habits of life in Britain.

Birds of America

Birds of America. By John James Audubon. New York. 1953. Macmillan. With 435 colored illustrations. $8.95.

This is a new edition of the volume first published in 1937 and bringing within covers reproductions of 435 Audubon bird paintings that were in the original Elephant Folio. Even though some of the color leaves a bit to be desired and the accompanying descriptive text is certainly at an irreducible minimum, this is still a handsome volume for the library. Its success thus far attests to public appreciation, which must have dictated the publication of a new edition.

Figaro

Stomach ulcers are proverbially an occupational disease of those engaged in the advertising business. And there was the usual quota of ulcers around the office of Moser and Cotins, Utica, New York, advertising agency. However, there was one member of the force who was regarded as exempt from this occupational hazard. He was Figaro, for eleven years happy and healthy around the place. Then he was noted to be passing up the most delectable mice. It was reliably reported that he had been heard to burp instead of purr. Figaro languished. Amateur diagnosis failed and Figaro was taken to a vet. Yes, the diagnosis was ulcers! And the advertising cat went on a meatless diet, with emphasis on lots of milk.

Conservation Primer

A Primer on Conservation. By Olin L. Kaupanger. Minneapolis 2, Minn. 1953. Federal Cartridge Company. 100 pages. $1.00.

Although head of a corporation making sporting ammunition, Charles L. Horn has long been a militant conservationist, and he supplies a foreword to this book by an associate. Mr. Kaupanger has written a reasonably well-rounded introduction to what are, for the most part, generally accepted ideas about conservation.

British Bird Guide

The Pocket Guide to British Birds. By R. S. R. Fitter, with a foreword by Peter Scott. New York. 1953. Dodd, Mead and Co. 240 pages. Illustrated with more than 1000 paintings and drawings, in color and black and white, by R. A. Richardson. $4.50.

Bird enthusiasts who visit Britian and who want a popular guide will find the answer in this pocket book. The text provides every help toward field identification, and the illustrations effectively collaborate to make the book highly useful. The author seeks to help the bird watcher know the British birds without having had any prior knowledge except of the relative size of a few common birds. There are, then, eight groupings based upon the size of eight key birds. Characteristic features are also emphasized and will provide a key to the identification of a bird otherwise imperfectly observed. We know several people headed for Britain and the Coronation, but with intent to get in as much birding as possible. No doubt this book will travel with most of them, and with many others.

Animals and Sex

The Sex Life of Wild Animals. By Eugene Burns. New York. 1953. Rinehart and Company. 290 pages. $3.00.

During the past thirty years the author of this interesting book has been gradually assembling the material for it. Through it he seeks to give the reader an understanding of the sexual impulse in wild animals, its relation to animal behavior, its connection with domesticated animals and the reflection of wild animal sexual impulses in the human animal. While the author's text is definitely popular and most interesting to read, the information is of wide interest to those who have any concern with wild animals, whether professionally or otherwise. Mr. Burns has made a distinct contribution to natural history.

Unfinished Business

Preview for Tomorrow. By Bruce Bliven. New York. 1953. Alfred A. Knopf. 347 pages, plus index. Illustrated. $5.00.

The subtitle of this book is "The Unfinished Business of Science," and in it Mr. Bliven has done a competent and intensely interesting reportorial job. It is a clear picture of how far we have come in meeting many challenges that must be answered by science, and what we may hope for in the future in the way of these answers. The third chapter of the eight that make up this book deals with the problems of saving our natural resources, both renewable and non-renewable. Our wildlife and recreational resources are ignored in favor of the basic resources of soil, water and forests, but so extensive is the coverage that the author attempts that it is inevitable that only the high spots can be touched in any flying trip around the world's science problems.

ANSWERS TO FLOWER QUIZ

1. Indian pipe
2. Flowering raspberry
3. Mandrake, or mayapple
4. Kansas gayfeather, or liatris
5. Bluebells of Scotland
6. The well-known bloodroot
7. Trailing arbutus, or Mayflower
8. Pitcherplant, or huntsman's cup
9. Clintonia, or blue beads
10. White baneberry, or doll's eyes.

Sequoia Grove Saved

The long fight for preservation of the South Calaveras Sequoia Grove and Beaver Creek Sugar Pines in California is being won. On February 6, the United States Forest Service and the Pickering Lumber Corporation signed a contract by which the lumber company transfers 378.7 acres of the finest sugar pine lands to the Federal Government in exchange for national forest stumpage of equal value. The exchange was made under an act of Congress passed in 1909 for the preservation of this grove — a law neglected and forgotten until rediscovered a few years ago by Gene Wilbur of California.

At the same time the State of California is nearing a purchase, from Pickering, of the first installment of the adjoining South Calaveras Grove. State funds have been matched by the transfer to State ownership of the "national forest corridor" of 1200 acres connecting the North and South Calaveras Groves — a transfer authorized by Congress in 1928.

The Emergency Conservation Committee of New York states that it takes pride in the part it has taken in this great campaign, having worked unremittingly since the publication of its pamphlet, "Protect the South Calaveras Sequoia Grove," by Irving Brant, in 1942. In that pamphlet preservation was sought for the Beaver Creek sugar pines, and western yellow pines, "the biggest and most beautiful pines in the world," and advocated the method finally adopted, that the lands "be obtained, partly with state park funds, partly by exchange of National Forest timber of equal value."

Still earlier, Dr. Willard G. Van Name had been conducting a one-man campaign for the preservation of the Beaver Creek pines. The Emergency Conservation Committee campaign became irresistible after John B. Elliott, retired Los Angeles oil man, took the lead in organizing the California War Memorial Park Association, five years ago. Since that time he has devoted his time and money to the preservation of this scenic forest as a memorial to the nation's war dead. It is largely owing to his efforts that the California State government, the California delegation in Congress (with Representative Chet Holifield in the lead) and State political leaders of both parties put themselves behind the project. President Truman and Secretary of Agriculture Brannan actively promoted the Federal-State transfer. It was effectually and faithfully carried through by Regional Forester Clare Hendee, and has been consummated with the approval of the new Secretary of Agriculture, Ezra Taft Benson.

The Federal and State governments will cooperate in administration of the new park, and it is anticipated that when the State's acquisition program is completed, Congress will be asked to transfer the federal portion of it to the State, which would adminster it for the benefit of all the American people.

Film of the Wild

"Traplines" is the title of a fine new film available from Defenders of Furbearers, 2126 LeRoy Place, N. W., Washington 8, D. C. This film was made in the wild by Dr. Harry R. Lillie, who followed the traplines and saw and recorded what happens along them. The film runs for thirty minutes and is in sixteen millimeter with sound and commentary. It is available for rental and information will be sent on request.

Forest Congress

October 29 to 31 have been chosen for the dates for an American Forest Congress called by The American Forestry Association to convene in Washington, D. C., to reexamine all aspects of forest management and protection on public and private lands in the United States. This is the fourth such meeting to be called by the Association, the first, in 1882, marking the beginning of a forceful forestry movement in this country.

Source Material

Always a helpful publication, *The American Biology Teacher* for February, 1953, performs another outstanding service by publishing a compilation by Muriel Beuschlein entitled "Free and Inexpensive Material for Conservation Education." The author deserves a special bow. It is to be hoped that this may be made available separately.

Nature Badge

Recently we commented in these pages on the new Boy Scout Merit Badge booklet on "Wildlife Management," expressing the thought that it might have had a bit more emphasis on general appreciation of wildlife. Now comes to hand the new leaflet in the badge series entitled Nature." This is an excellent job by Ted S. Pettit of the national staff, B. S. A., and this booklet should be considered together with Durward Allen's excellent booklet on the management phase. It is likely that most boys will take badges in both subjects, so closely are they allied. If they do they will have a good basic foundation in both Nature appreciation and Nature use.

4-H Club Manual

"Manual of Wildlife Conservation for 4-H Club Members" is a 63-page illustrated bulletin of the University of Illinois College of Agriculture. It is designed to point out practical ways in which 4-H Club members can carry on conservation programs. It acquaints these young people with the ecological relationships of the rural areas from the conservation point of view.

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IN THE ZODIAC

(Continued from page 269)

shifted gradually another 30 degrees along the ecliptic and backed into the constellations lying directly westward of the ones in which they are now located.

The constellations of the Zodiac differ greatly, one from another, in size and in brilliancy. There are only five first magnitude stars in the Zodiac — Aldebaran, in Taurus; Pollux, in Gemini; Regulus, in Leo; Spica, in Virgo; Antares, in Scorpio. If one wishes to recognize easily the brighter planets one should be able to recognize also, beyond any question, these brightest stars in the Zodiac. Mars at times passes near Aldebaran and again, at times, near Antares. All three are red, and there are also times when Mars does not differ greatly from either of them in brightness. Saturn at times passes near Spica and Regulus. The difference in brightness may not be great, but if one learns to recognize the bright stars by their distinctive positions in the constellations to which they belong one will never mistake a star of the Zodiac for a planet nearby, for the time, and similar in color or brightness. Jupiter and Venus are too brilliant ever to be taken for any bright star in the Zodiac. Occasionally one planet may be mistaken for another, but not if one has come to know them well. Venus so far surpasses all planets and stars in brilliancy at all times that it should never be mistaken for any other object.

The three most brilliant of the zodiacal constellations are Gemini, the farthest north of all of them, and Scorpio and Sagittarius, far south in summer evening skies. These two constellations lie in the Milky Way, which adds to their splendor. They appear to best advantage in tropical skies, where they pass high overhead. Cancer is the most inconspicuous and least interesting to observe of all the zodiacal constellations. Pisces is large but poorly defined. Virgo is the largest of all. Taurus rivals Gemini in interest, for in it are the two beautiful clusters of the Hyades and the Pleiades. No constellation of the Zodiac is without interest for through them all, sooner or later, pass the planets, as well as, for us, the two most interesting objects in the heavens and the two most frequently observed, the sun and the moon.

On May 24 Mercury and Jupiter will be in conjunction with the sun and with each other. As Mercury is at superior conjunction on that date it then passes from the morning to the evening sky, while Jupiter passes from evening to morning sky. Both planets are in poor position for observation this month. Venus starts the month low in the east at sunrise but is increasing its distance from the sun rapidly. It is at maximum brilliancy on May 19. Mars is now in Taurus and too low in the west at sunset to be easily observed. Saturn is in Virgo north of Spica this month, well up in the east at sunset, and will set after midnight. It is now in fine position for observation.

Merry Hall

Merry Hall. By Beverley Nichols. New York. 1953. E. P. Dutton and Co. 319 pages. $3.75.

Here is a book that should delight everyone who gardens, particularly anyone who enjoys the charms of old gardens that frame old estates. The author takes over an old Georgian house and with it acquires a deserted garden. These he sets out to restore to some semblance of their former splendor against the background of rural England. Into the resulting story, which is certainly part fiction, he has woven much garden lore and advice, drawn a picture of a number of interesting characters, and given the reader a delightful reading experience.

PEQUOT-SEPOS, A UNIQUE COMMUNITY PROGRAM

(Continued from page 267)

their present condition in so short a time, a condition which he regards as merely an inadequate beginning, Curator McElroy is working on the aforementioned book, puts out singlehanded the Sanctuary publication, and keeps numerous outside lecture dates! For these lectures, when they are given within the subscription area, no charge is made. Naturally, when he is invited further afield to Hartford, Greenwich or New York, the Association feels that a less unusual financial procedure is in order.

Among many interesting projects for the immediate future perhaps one de erves special mention. There are several small ponds and marshy spots scattered in the woods throughout the rugged terrain of the Sanctuary. However, it is felt that a much larger pond, located in the open meadows at the west end of the tract, would provide a valuable element that is not now present. It would furnish a setting quite different from the existing forest pools for ecological studies. In addition, since Pequot-sepos is directly on a main migratory bird flyway from Canada and northern New England across Long Island Sound, it would constitute a valuable and safe staging area for the migrations.

Funds for this development, unfortunately, cannot be squeezed out of the current annual budget. It is typical of Pequot-sepos and its curator that that was not the end of that. The dam will go in. It will go in because one of several individuals now considering the matter will be proud to have the Pequot-sepos main pond named in his honor!

Pequot-sepos is more than just another exceedingly well run wildlife sanctuary. Its program of promoting conservation education by demonstration, in cooperation with schools, community centers and youth organizations, may perhaps be equalled elsewhere. In its series of adult and youth lectures for the public as well as for its members, by its curator and by speakers of national reputation, it may even be surpassed in other, richer areas. However, in one way Pequot-sepos stands by itself. In one way this small sanctuary at the headwaters of the Little River of the Pequots is unmatched, it is firmly believed, in the entire United States. It is a locally supported conservation enterprise dedicated to the teaching of the principles of conservation on a community level.

As such it is unique! As such it is worthy of every support. And as such it is worthy of emulation elsewhere!

Petrology

Theoretical Petrology. By Tom. F. W. Barth. New York. 1952. John Wiley and Sons. 387 pages. Illustrated. $6.50.

This book presents the status of our present knowledge in all fields of petrology, covering igneous, sedimentary and metamorphic rocks. This is, therefore, an exact and comprehensive scientific study of the rock-making processes, and an interpretation and synthesis of the existing quantitative data.

Rocks

Rocks and Their Stories. By Carroll Lane Fenton and Mildred Adams Fenton. New York. 1951. Doubleday and Company. 112 pages. Illustrated. $2.50.

This introductory book to knowledgeable collection of rocks and minerals is specially prepared for the young collector or for the adult beginner. It provides in popular terms basic information on rocks, stones and minerals; gives specific advice on where to find specimens. The excellent illustrations supplement the text and are valuable aids in identification. With the army of rock hounds growing rapidly, this book will be most valuable to the newcomer to the ranks and will guide him or her on the way to full enjoyment of a popular hobby.

Geology Guide

Geologic Guidebook of the San Francisco Bay Counties. Prepared under the direction of Olaf P. Jenkins. San Francisco. 1951. Division of Mines, State of California, Ferry Bldg., San Francisco 11. 392 pages. Illustrated and with maps. $2.50, plus 3% sales tax for residents of California.

An imposing number of authors have contributed to this valuable book, which covers the history, landscape, geology, fossils, minerals, industry and routes of travel of the twelve counties in the San Francisco Bay area. Issued as Bulletin 154, this volume contains a vast amount of information and much fascinating material on the early days of the area. It is most valuable to anyone wishing to know intimately the interesting region.

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UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

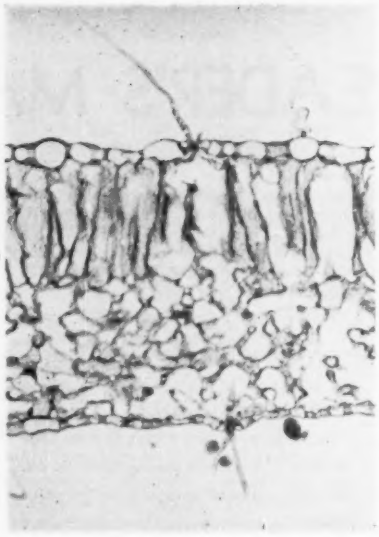
POTATO LATE BLIGHT

IN A past generation, the vaudeville slapstick man always managed to work in some reference to "the year of the Great Potato Rot and the High Wind." This was considered excruciatingly funny, and was good for many a boffo; but a century ago it was far from funny, marking, in fact, one of the great national tragedies of history.

One of our favorite books, as we have several times remarked in these columns, is *The Advance of the Fungi*, by E. C. Large, published by Henry Holt & Co., in 1940. It is an entertaining work on the history of man's discoveries in mycology and the effects fungi have had on civilization. Here is described the pitiable estate of the Irish peasant farmer in 1845, and how he was reduced to absolute starvation in that and following years, when an unknown and unsuspected microscopic enemy struck with devastating thoroughness and ruined his potato crop. A million persons died from starvation and its effects in Ireland alone, and a million and a half emigrated, the total representing more than fifty percent of the entire population of the Emerald Isle. The evils of a culture based on a single crop have never received a more spectacular demonstration, or human greed, on the part of the land-owning class, a more sordid exposition.

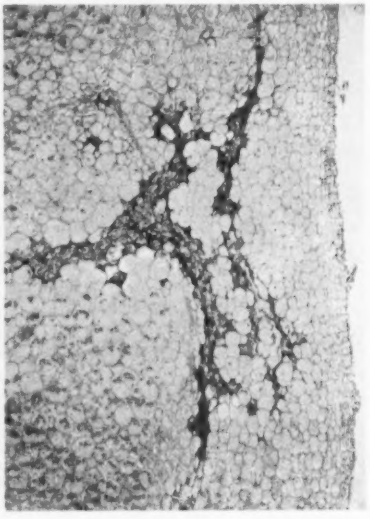
This remarkable sociological eruption had as its basis an organism now known as *Phytophthora infestans*, the Potato Late Blight Fungus. Biologically the case is one of parasitism of a lowly organized or primitive plant upon a highly organized or advanced one, equivalent to the predation of the malarial parasite upon man. Spores of this fungus are exceedingly minute and light and are carried by the wind. Where potato cultivation is widespread, many spores will fall upon leaves of healthy plants and, in wet seasons, germinate and penetrate the leaf, starting a new infection.

A few terms used in *mycology* — the study of the fungi, from the Greek word for mushroom — are useful in describing the structure and life history of this kind of plant. Germination of the *spore* results in growth of its substance, primarily by water absorption, into a *germ tube* that penetrates the potato leaf, either through a stoma or the unbroken epidermis, and elongates to form a strand or filament, the first *hypha* (web). Through continual apical growth, the tip keeps advancing, branching and ramifying through the intercellular spaces of the host leaf to make a maze of filaments known collectively as the *mycelium*. All along the many hyphae composing this



SLIDES COURTESY TRIARCH BOTANICAL PRODUCTS; G. H. CONANT, RIPON, WIS.

Section of infected potato leaf, showing mycelium of blight fungus ramifying through spaces and sending hyphae out through stomata. Below, section of infected potato tuber.



mycelium are small lateral suckers, the *haustoria*, that penetrate the leaf cells and rob them of their substance.

Soon some of the hyphae grow out throught the stomata of the leaf and, destined to produce *air spores*, are called *sporangiophores* (spore-case bearers) by some mycologists, *conidiophores* (conidium-bearers) by others. The first term is the more general, the second refers to the particular type of air spore found in this group of fungi. At the tip of each such hypha a conical or pear-shaped body is produced, the *sporangium* (spore-case) or *conidium*, a word derived from the Greek for "dust," in allusion to the extremely small size of these particles. The tip of the hypha now grows on past the conidium so that the latter comes to be lateral instead of terminal, and as the hypha continues to branch and each new tip produces another conidium, a single original conidiophore bears many spore cases. Since each leaf has a great number of stomata and hyphae emerge through a single stoma in clusters, the total number of sporangia produced by one mycelium becomes astronomical.

But that is not yet the end of the story of multiplication. When blown to new potato plants, the conidia behave in two different manners, depending upon temperature and moisture conditions at the time and place. Each conidium may form a germ tube that penetrates the new host plant directly as the forerunner of a new mycelium, or the conidium may divide into a number of daughter cells, each a *zoospore*, so called because it develops two flagella and can swim about like a protozoan animal. A zoospore can enter leaf or stem and it is presumably these spores that are washed into the ground in rainy weather and thence infect the tubers, so that they rot either in the ground or when stored in bins.

In 1885 the French professor Millardet published his formula for a combination of copper sulphate and lime that came to be known as *Bordeaux mixture*, the invention being highly circumstantial. It appears that vintners in the Medoc region had taken to sprinkling either copper sulphate and lime, or verdigris, which is a conglomeration of several copper acetates, upon grape foliage accessible from paths in order to discourage boys from stealing the grapes. Millardet noted that such vines were free from grape mildew, a scourge that was threatening the wine industry of France, whereas neighboring but unsprinkled vines were bare and ruined by this fungus. Millardet conducted many experiments, settled upon that combination of chemical ingredients found to be most effective, and within a few years vineyards were being restored, and by 1885, the year he published his formula, the new discovery was already being applied to the control of potato blight. Today, insecticides and fungicides enable the intelligent farmer to anticipate a crop of potatoes with confidence.

The great potato rot of 1845 in Europe generally and Ireland more particularly is an example of an *epiphytotic* — an interesting word that means "upon the plants," just as *epidemic* means "upon the people." As an aside, it may be noted that the simpler spelling *epiphytic*, similar in formation to *epidemic*, could not be used as it had been preempted by ecologists to indicate the habit of one plant growing upon another, as orchids on tree limbs. Inconsistently, the plant pathologist does not use *endophytotic* (in the plants) to denote the condition wherein a disease has become an established part of the picture in some region. Instead he uses *endemic* (in the people), as in the phrase, "potato blight is now

endemic in Ireland."

According to Wolf and Wolf, *Phytophthora infestans* evolved in the northern Andes, original home of the potato. The blight spread to North America and Europe between 1830 and 1840, to India between 1870 and 1880, and into South Africa and Australia between 1900 and 1910. Well nigh impossible to eradicate over this worldwide area, potato late blight is now held in control through an intelligent understanding of the nature of the blight organism and how it is propagated and spread, the essential tool in all of the huge amount of research that gave man victory over the fungus being the microscope.

HISTORICAL OUTLINE

IN THIS brief survey of the history of parasitology we have arrived at the time and place to consider the most important of the founding fathers of this new science. This was Karl Georg Friedrich Rudolf Leuckart, born in 1822 at Helmstadt (now spelled Helmstedt), Brunswick, Germany. His father was a successful business man who could give his son the best in education, and so young Rudolph was sent to Gottingen, one of the several great German Universities that became so renowned in the 18th and 19th Centuries. Zoology ran in the family, too, as his uncle was Friedrich Sigismund Leuckart (1794-1843), professor of this science at Freiburg.

After graduation, young Rudolph remained at Gottingen as lecturer and soon gave notice that he was to become an intellectual power of the first rank by publishing important findings. His achievements through a long life were so many that perhaps a chronological presentation will display the principal facts with the saving grace of brevity.

1847—aged 25—lecturer at Gottingen. Distinguished between sexual reproduction and such asexual methods as fission and budding, studying particularly the polyps and jellyfish of the Phylum Coelenterata. He split up Cuvier's old Type Radiata, naming the Coelenterata and recognizing the Echinodermata as a distinct and more advanced group. He described polymorphism in colonial coelenterates; that is, the presence of more than two kinds of individuals in the same species. Nearly all higher animals have two kinds, males and females; polymorphic species have more than this, as the worker bees or nurse ants. In coelenterates the various individuals are produced asexually by budding and grow to be very unlike in structure and function, some becoming feeding polyps, others fighting (defense by stinging), others reproductive, and finally there is a flotation polyp, notably in the Portuguese Man-O'-War. In this species division of labor reaches unprecedented heights, resulting in a colony of differentiated individuals that are so closely associated as to appear to be a single organism. All of this and many other new observations and ideas appeared in a remarkable work on invertebrate zoology, *Ueber die Morphologie der Wirbellosen Tiere*, that constituted a great advance over previous concepts; all the more remarkable as the product of a man so young and not yet professionally recognized beyond his own threshhold. This work went far to remedy that situation.

1851—a follow-up on the preceding constituted a separate publication, *Ueber den Polymorphismus der Individuen*, in which he also confirmed Steenstrup's work on alternation of generations and carried it further.

1855—appointed professor of zoology at the University of Giessen. In this year also he announced the first of his findings on *Trichinella*, marking at the same time the first of a long list of important discoveries and publications in parasitology, a field not then recognized as a separate department. He fed *Trichinella* cysts to host animals and found adult worms in the host's duodenum shortly thereafter. Females produced living young which then migrated to and encysted in muscles. Since this dreaded enemy of man kind is a major parasite, this work was indeed significant and greatly enhanced Leuckart's rapidly growing reputation.

1856—a year after Kuchenmeister had worked out the life cycle of the pork tapeworm of man, *Taenia solium*, Leuckart also independently performed the same research and went on to demonstrate that the bladderworm or cysticercus found in pork was the infective stage that, if eaten uncooked by man, becomes an adult worm.

1861—turning his attention to the other human taenia, he was the first to show that cattle are the intermediate hosts for the beef tapeworm of man, *Taenia saginata*.

1862—in this year Leukart repeated von Siebold's work of 1852, feeding scolices or "heads" of the cysts (bladderworms) of the tapeworm *Echinococcus granulosus* to dogs, later recovering adult worms in the dogs' intestines. This is the species that, as a larva, sometimes infects man, with dangerous to fatal results.

1863—first appearance of *Die menschlichen Parasiten* (the parasites of man). Revised in 1876, it was reissued in 1879 as *Die Parasiten des Menschen*, with numerous further editions; reprinted in 1901. Faust states that this is the only text prior to the 20th Century that is of any value today, other than historical. Many of the contained drawings are still in use in modern texts, as Chandler, Pratt. This master work of Leuckart's added enormously to his prestige. In this same year he described a new tapeworm, *Bothriocephalus cordatum*. Now known as *Diphyllobothrium cordatum*, or by still other synonyms, according to the revision preferred, this is a large parasite sometimes obtained by man from eating raw fish. Another discovery of this year was *Dipylidium caninum*, the double-pored tapeworm of dogs that sometimes infests man.

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1865 — described the life cycle of *Enterobius vermicularis*, the pinworm of man.

1866 — *Untersuchungen ueber Trichina spiralis*, the summation of his researches on the trichina worm.

1867 — Leuckart observed the development in mealworms of *Maslophorus muris*, a spiuroid worm parasite of mice. This was the pioneer discovery that insects may act as intermediate hosts for worms that use vertebrates as final hosts. Two years later his student, Melnikov, showed that the larva of *Dipylidium* develops in dog lice.

1869 — appointed professor of zoology at the University of Leipzig, his final position. Leuckart was now world famous and attracted large numbers of students from all over the globe.

1879 — proposed the name Sporozoa for that class of protozoans, all of which are parasitic, containing coccidial and malarial organisms, among many others.

1882 — made the very important distinction that the free-living and the parasitic phases of the roundworm, *Strongyloides stercoralis*, thought to be separate species at the time, were parts of the life cycle of the same animal. This year also saw the consummation of his long labors with *Fasciola hepatica*, the sheep liver fluke, by completion of the life cycle. Leuckart's paper appeared in Vol. I of the *Archiv fur Naturgeshichte*, pages 80-119, and was entitled *Zur Entwicklungsgeschichte des Leberegels* (*Distomum hepaticum*), — life history of the liver fluke (literally, "liver-leech") appearing in Archives of Natural History. This classical work, the first life history worked out for any trematode, soon became incorporated in all zoology texts and attracted wide attention through its interest and complexity. Strangely enough, as a coincidence, the same observations were independently performed in this same year by A. P. W. Thomas, in Australia.

1893 — first description of *Filaria volvulus*, a tumor-forming filarial worm from West Africa, now called *Oncocerca volvulus*.

1898 — death of Leuckart, aged 76.

This famous zoologist exceeded even von Siebold in gifts and accomplishments. Before he was forty his fame as a lecturer attracted wide attendance. Even in his old age he was outstanding for his kindliness, his warm interest in people in general and his students in particular, his helpfulness, and his humor and originality, so that, in passing, he was universally mourned and praised by those who knew him or his work. His monument remains today in the foundations he so skillfully laid in zoological classification, in morphology, and in parasitology; in the celebrated Leuckart wall charts, still used in colleges and universities throughout the world, unsurpassed in conception and execution; and in the accomplishments of the many outstanding students he trained, foremost of whom was August Weismann.

SCIENTIST'S PENCIL

SCRIPTO, Inc., Atlanta, is out with a propel-repel pencil with pocket clip that uses a thick lead, red or blue, for writing on glass, porcelain and other smooth surfaces where ordinary pencils or pens are useless. This is an excellent laboratory aid and a great help to the microscopist. When the lead is withdrawn the pencil is carried clipped to the pocket without danger of soiling the jacket, yet is instantly available to mark any beaker, flask, testtube, or other item of equipment. We have found this pencil ideal for the temporary labeling of microslides during their preparation, and also for writing on wood or paper and addressing parcels — wherever the writing must be large and conspicuous. A pencil with one lead is 25c, and an extra box of four leads, red or blue, is 15c. There are also heat resistant leads, red or black, that will withstand firing up to 2250°. Specify the item desired and order from Southern Scientific Co., Atlanta 3, Ga.

EDUCATED BACTERIA

SOME while ago we were intrigued by an illustration that appeared on the cover of a folder issued by the Carolina Biological Supply Company, at Elon College, N. C., describing their culture service for bacteria and fungi. The caption under this picture, reproduced herewith, was: "*Sarcina flava*. The words 'Carolina Cultures' in above illustration are actual living bacteria."

Now most bacteria have never been taught to spell, much less write; so we corresponded with the Company to learn how this lettering was accomplished, and through their courtesy we are presenting the photograph and the method of its preparation.

1. Pour about 25 cc of nutrient agar into a Petri dish. Make it as follows:

Nutrient Agar

Agar agar	2 g
Peptone	5 g
Beef extract	3 g
Distilled water	500 cc

2. Sterilize the dish of nutrient agar in an autoclave at 15 pounds pressure for 15 minutes. The private worker can use the familiar pressure cooker for this purpose. If you do not have access to either of these pieces of apparatus, it is not difficult to assemble the simple materials needed to construct a homemade Arnold stean sterilizer, as explained and pictured in the January, 1940, issue of this Department, in the article, "Culturing Bacteria."

3. After taking the plate out of the autoclave, cover with a towel immediately to reduce condensation on the underside of the top cover.

4. Close all nearby windows and minimize air currents, then with a sterile loop, enter a tube of *Sarcina flava* and pick up a generous amount of the bacteria. Expose the sterile plate and *quickly* print the desired letters. Cover the plate immediately.

5. Allow to grow overnight at room temperature

6. On the following day, use a sterile loop to touch up the lettering; that is, make all letters even and equally heavy.

NUTTY ASTRONOMERS

CONCERNING the original and transposed meanings of the word *diaper* (this Department, Aug.-Sept., 1952), our photomicrographer, John Butterfield, writes:

"Birdseye cloth is the old choice material especially desired for infant's three-cornered pants; the term 'birdseye' apparently arising from the manner in which the warp and weft are varied to produce the characteristic diamond pattern in the cloth. This produces an excellent absorbent and soft fabric, highly desirable for cleaning precision lenses after having served duty as diapers and gone through many washings so that it is soft and lint-free. The Harvard Observatory station in Colorado, where they study the sun's corona, swaps new birdseye diaper cloth to the housewives thereabouts for their babies' old ones that have undergone repeated launderings and are about ready to fall apart. Needless to say, the mothers think the astronomers are really nutty!"

SONGS FOR ZOOLOGY

Without A Frog

Without A Song

Vincent Youmans

Without a frog the pond would never scum
Without a frog we'd hear no "Jug-O'-Rum!"
No pollywog has ever hatched and swum
Without a frog.
Those stools in lab. would be deserted now
Dissecting pans would be inverted now
That course in Zo would be no good nohow
Without a frog.
If I have learned all the bones
And all the hormones
The endocrines send,
The wherefore and why
Is owing to my
Batrachian friend!
I'll never know what makes blood pressure fall
I'll never know what makes giraffes so tall
I only know there ain't no Zo at all,
Without a frog.

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